

Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

Farmers' Bulletin 1125
United States Department of Agriculture

FORAGE FOR THE COTTON BELT



THE FORAGE CROPS adapted to the cotton belt are mostly different from those utilized in the North and West, mainly on account of climate but partly due to soil.

Each important forage plant is described in sufficient detail to indicate its relative value and the points necessary to heed in its successful culture. In most cases references are made to Farmers' Bulletins of the Department giving more detailed cultural directions.

Meadows and haymaking are fully considered. A good hay plant should make a large growth, be leafy, have fine and tender stems, be palatable, and grow so erect that it can be cut readily with a machine.

The best hay made from any crop is always that which is made the most quickly and with the least exposure to sun and air.

Permanent pastures in the cotton belt should have as their foundation either Bermuda grass or carpet grass. Bermuda grass is best on all heavy soils, while carpet grass is superior on sandy or sandy loam soils. Lespedeza, bur clover, and Augusta vetch are important in mixture with the grasses.

The silo is of less importance in the cotton belt than in regions having shorter grazing seasons, but it is usually a profitable investment for the dairyman.

Soiling is often more economical than grazing, especially where land is expensive, as it enables the farmer to produce more feed from the same area of land.

Owing to the great number of forage crops adapted to the cotton region there is room for considerable difference of opinion as to the best sorts for use in any given locality. Definite recommendations of forage crops by the experiment-station authorities in the States included in the scope of this bulletin are given.

Contribution from the Bureau of Plant Industry

WM. A. TAYLOR, Chief

Washington, D. C.

Issued October, 1912, as
Revised May, 1920

F. B. 5097

FORAGE FOR THE COTTON BELT.

S. M. TRACY,

Agronomist, Office of Forage-Crop Investigations.

CONTENTS.

| | Page. | | Page. |
|--|-------|--|-------|
| Southern forage crops highly profitable..... | 3 | Hay crops..... | 51 |
| Soils..... | 3 | Pastures..... | 56 |
| Hay and pasture grasses..... | 5 | Silage crops..... | 58 |
| Coarse fodder grasses..... | 23 | Soiling crops..... | 59 |
| Legumes..... | 28 | Recommendations by the agriculturists of | |
| Miscellaneous forage crops..... | 47 | southern experiment stations..... | 60 |

SOUTHERN FORAGE CROPS HIGHLY PROFITABLE.

THE SOIL AND CLIMATE of the cotton-growing region are in the main so unlike those of other parts of the United States that different crops, and to some extent different methods of management, are necessary to secure the most profitable crops of forage for grazing, soiling, and haymaking. In this region Bermuda grass, Japan clover, velvet bean, beggarweed, Mexican clover, Rhodes grass, and a number of other forage plants which can not be grown elsewhere give highly profitable returns, while the common forage crops of more northern regions—timothy, red clover, bluegrass, and others—have little value. During the last 20 years much progress has been made in determining or finding the most valuable of the numerous forage crops adapted to the cotton-growing region and in the management of both meadows and pastures.

The climate in this region is so warm that growth continues nearly or quite throughout the year, so that it is possible to grow a great variety of forage crops suited to one season or another. The rainfall ranges from about 60 inches near the Gulf coast to about 40 inches at its northern limit. The frostless period of eight or nine months insures a very long season for pasturing.

SOILS.

The selection of the best forage crops for any given region is determined to some extent by the character of the soil. Based on soil, the cotton belt may be divided into rather distinct sections, at least so far as forage crops are concerned. (Fig. 1.)

The Piedmont Plateau.—The Piedmont area is extensive in the Carolinas, Georgia, and Alabama. The country is rolling and well drained, covered originally with timber, mostly of hardwoods. The soils are for the most part reddish clays or clay loams and usually are poor in humus. In general they lack cohesiveness and easily become gullied unless carefully handled. To prevent washing on slopes the practice of terracing farms is general. When skillfully managed the Piedmont soils are among the most productive in the South.

River valleys or flood plains.—Alluvial soils cover thousands of square miles along the Mississippi, extensive valleys along the Red, Pearl, and other large rivers, and smaller areas along nearly all the

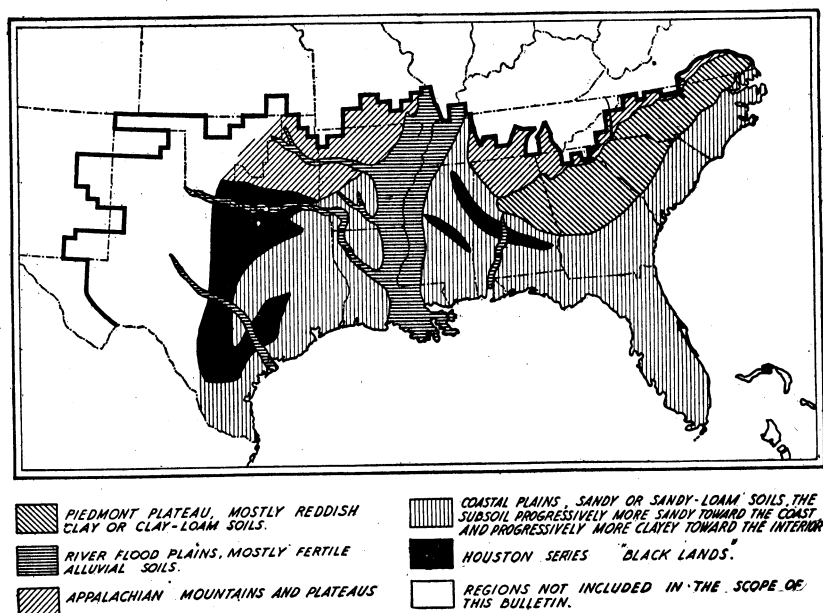


FIG. 1.—Map of the southeastern portion of the United States, showing the principal soil provinces of the cotton region. The heavy black line marks the northern and western limits of cotton cultivation.

streams. Such soils are always very productive and along the larger streams are usually rich in lime, though this element is sometimes scanty in alluvial soils along the smaller streams which have their source in the upland clay or sandy pine region.

Appalachian Mountains and plateaus.—This area includes the southern end of the Appalachian Mountains and the Ozark region—all hills and plateaus of considerable altitude but still within the area where cotton is cultivated. The soils are varied, but on account of the cooler climate many of the northern forage plants succeed well.

The black lands or Houston series of soils.—The black-land areas lie principally in northwestern Alabama and northeastern Mississippi and are very similar in character to the extensive "black-wax"

soils of Texas. These soils all belong to the Houston series. They possess an abundance of lime and are exceedingly productive but require careful handling. As a rule the natural drainage is poor, and if plowed while wet an artificial hardpan, or plowsole, is soon formed, especially if the land is plowed always to the same depth. When this plowsole is formed, both cotton and grain crops are likely to suffer severely from insufficient drainage in wet weather and from drought in dry weather. By a deep plowing, this hardpan may be broken up, but it is better practice to plow the land at a different depth each season, so as to avoid its formation. To some extent plants with strong taproots, like alfalfa, will penetrate and break up the hardpan.

The Coastal Plains.—The Coastal Plains occupy nearly half the area of the cotton region. The greater part of the area was originally covered with timber, consisting either wholly or predominatingly of pine, for which reason it is often spoken of as the piney-woods region. The soils are of many types, important among which are the Orangeburg, Norfolk, Ruston, and Portsmouth series. In general the surface soil is sandy or sandy loam, which toward the interior is underlain with clay and toward the coast becomes more sandy. In poorly drained areas, called "flatwoods," the soil naturally contains much humus, and this increases through soils of the different series up to the pure peat deposits in the swamps. With suitable crops and proper treatment the sandy soils produce excellent yields. Where the subsoil is clayey the soils are as a rule better, but nearly all are low in lime content.

HAY AND PASTURE GRASSES.

Few of the grasses most grown in the Northern States are useful in the cotton region, as they do not thrive during the long period of warm weather. No one hay grass possesses in the South an importance corresponding to timothy in the North, and it is hardly likely that any such grass will ever be discovered. On this account, success in hay growing requires a knowledge of the relative value and methods of culture of the various grasses that are adapted to southern conditions.

BERMUDA GRASS.¹

Bermuda grass is the foundation of the best permanent pastures in the South, especially on clayey soils. It endures severe drought and long flooding by water and makes excellent grazing from late spring until heavy frost. On rich and fairly moist clayey soils it grows large enough to be cut for hay, the quality of which is excellent. It is one of the best grasses for creek and river bottom lands, for binding

¹ Tracy, S. M. Bermuda grass. U. S. Dept. Agr., Farmers' Bul. 814, 2 fig. 1917.

levees and ditch banks, and for lawns which have good care. It is propagated either by seed or by "roots," this term as here used including both the underground stems or rootstocks and the creeping runners.

As the seeds of Bermuda grass are very light and small, the ground should be put in the finest possible condition before they are sown. The sowing should not be done until late in the spring, when the soil has become fairly warm. Immediately after cotton planting is generally the best season for the work. When good seed is used 5 pounds per acre are sufficient. Before sowing, the seed should be mixed with sand or fine soil, to increase the bulk and thus secure a more even distribution over the field. The seeding should always be broadcast and can be done either by hand or by using a wheelbarrow seeder. In any case it is better to sow only half the seed the first time the field is gone over and then the other half, going over the field at right angles to the direction in which the first half was sown, so as to cover skips and balks. If possible, a roller should be used for covering the seeds, but if that is not available a light smoothing harrow or a drag made of brush may be employed. The covering should always be very shallow, and therefore the use of a roller is of great advantage, as it packs and firms the soil without covering the seeds too deeply.

When the seed of Bermuda grass is planted in the spring on well-prepared soil the plants will cover the ground by midsummer and will give a considerable amount of pasturage in the fall, or on the best soils a cutting of hay. It is useless to plant seed on poorly prepared land. Ground seeded in the spring should not be pastured until the sod has become dense, so that it will not be injured by trampling. When bare spots are found they can be filled in by transplanting roots from the thicker places at any time during the summer.

Roots and cuttings are used in propagation much more commonly than seeds. In planting, fresh sods about an inch in thickness should be taken up, either by using a spade or a plow, and then torn into very small pieces for distribution. It is a common practice to plow furrows 4 to 6 feet apart and then drop pieces of sod every 2 or 3 feet and cover with the foot. This method of planting is very inexpensive and answers well where the land is to be used as a pasture, but it leaves the surface of the ground too rough and uneven for a good meadow. If the entire surface is plowed, the pieces may be dropped 2 or 3 feet apart and pushed into the soil with a forked stick, such as is used in setting out sweet-potato vines, and then stepped on, to firm the soil and prevent drying out.

Another method is to plow the old sod very shallow, harrow until the roots are well loosened, rake into piles or windrows, and load into

a wagon. The wagon is then driven across the freshly prepared field in which the planting is to be done and the roots dropped about 2 feet apart in the wheel tracks and covered with the foot. The ground should be gone over twice, lapping the spaces, so that the rows will be only half as far apart as the distance between the wheels. An ordinary wagon box will hold enough roots to plant 1 to 2 acres, depending on how finely the roots are divided and how carefully the work is done. Planted in this way, Bermuda grass will cover the ground in a few weeks and the total expense, including the preparation of the ground, need not be more than \$5 an acre.

When a field is to be planted for a meadow it should be prepared as carefully as for seeding. Since it is to be a permanent field for mowing and will be used many years for that purpose, all bumps and hollows should be smoothed off, so that the mowing machine and rake may run over it smoothly without being injured by racking and in order that there may be no low spots in which water might stand.

The soil on which Bermuda grass is grown and the treatment which it receives cause great variations in its growth. Plants which when grown on a rich and moist soil make a rank growth, a foot or more in height and with long leaves, when transplanted to a hard clay soil may make a flat and spreading turf with stems only 2 or 3 inches high and with very short leaves. There are, however, a few varieties which are quite distinct from others wherever they may be planted.

The most common variety, which is in almost universal use wherever Bermuda grass is grown, produces stems only about a foot or less in height, though varying greatly. It produces abundant rootstocks, which often run several inches below the surface of the ground, and also makes surface runners, which may be from a few inches to several feet in length.

Giant Bermuda grass,¹ introduced from Brazil a few years ago, is the most rank growing sort yet found. On rich and moist soil it often makes runners 20 feet or more in length and an abundance of ascending stems 2 feet or more in height, affording two or three annual cuttings and yielding more than any other variety yet tested. It has no underground branches and usually produces but few blossoms.

St. Lucie grass is a dwarf variety from Florida, where it is very popular for lawns. It has no rootstocks and is not nearly as resistant to cold as ordinary Bermuda grass.

Many farmers hesitate to plant Bermuda grass for fear that it can not be killed out when the land is wanted for other purposes. It may be thoroughly eradicated, however, when advantage is taken of its peculiarities. It is almost impossible to kill Bermuda grass by cultivation in the summer or by deep plowing at any season. In the

¹ *Cynodon dactylon* var. *maritimus*.

northern part of the Bermuda grass region it can be almost or wholly eradicated by a very shallow plowing late in the fall, leaving the furrows on edge as much as possible, so that the roots will be frozen during the winter. Few of the roots will survive a single heavy freeze when turned up and exposed to the air. Farther south, where frosts are less severe, the grass must be killed by smothering. Bermuda grass will bear great heat, drought, and sunshine, but it will not thrive when shaded. When it is desirable to destroy a field of Bermuda grass it should be plowed in September and planted with oats, rye, barley, or some other winter crop. When that crop is harvested the ground should be disked or plowed at once and then planted with cowpeas or velvet beans. When the legume crop is removed, there will be little, if any, Bermuda grass left. This gives two profitable crops during the year and leaves the ground in prime condition for corn or cotton the following season.

CARPET GRASS.

Carpet grass is to the light and sandy soils what Bermuda grass is to the heavier and richer soils. It reaches its greatest perfection on the light soils near the Gulf coast, where it comes in very quickly when the land is heavily pastured and trampled; and it is more or less common as far north as central Georgia and northern Louisiana. Its creeping habit of growth enables it to bear close grazing without injury. It is strictly a pasture grass, seldom growing large enough to be worth cutting for hay. It will stand close grazing and heavy trampling better than any other grass in the Gulf region; in fact, considerable trampling seems advantageous to it, as it is smothered out by weeds in time if the land is not kept closely grazed.

The usual method of propagation is to cut some of the grass which has been allowed to mature seed and to scatter the hay over the pasture in which it is wanted. Little seed is produced where the grass is grazed closely, but when animals are taken from a field in July or August an abundant supply of seed can be secured in September or October. The grass grows readily when scattered on the surface of the ground, and comparatively little seed is needed. When even a few patches become established in a pasture it soon spreads over the entire field, and on a field which is well trampled it will make a good sod in about two years, even where the ground has never been plowed. A quicker and surer method of propagation is by transplanting pieces of old sod, as Bermuda grass is propagated, but this is much more laborious and expensive.

Although carpet grass makes little growth after the first heavy frosts in the fall, it furnishes good winter grazing if stock have been removed from the field in July or August, as it will make a growth of 6 to 12 inches by November, and the lower stems and leaves which are protected from frost will remain green and give fresh grazing

through the winter; but pastures which have been grazed closely all summer give little winter feed. Like Bermuda grass, it needs sunshine for its best growth, though it makes considerable good feed in wooded pastures and brush land. Good carpet-grass pasture will carry at least as much live stock as good bluegrass pasture.

JOHNSON GRASS.

Johnson grass makes a heavy yield of excellent hay and gives good grazing for one or two seasons, but is such a pest when growing in fields where it is not wanted that its planting in clean fields can not ordinarily be recommended. It makes its best growth on heavy soils, especially on the black prairie lands, clay soils rich in lime, and black-wax lands of Texas. On light sandy soils its growth is weak. On soils suited to its growth it yields very heavily for two or three years, after which the thick, heavy rootstocks become so matted that the yield is greatly reduced. If such land is to be kept as a meadow it should be plowed and harrowed about once in three years, after which it will yield as heavily as ever. The hay made from Johnson grass is of excellent quality if cut before the seeds are formed, but as the plants mature they become tough and fibrous. The grass does not bear grazing well, as the rootstocks are weakened and the growth of stems and leaves becomes very small.

Grazing does not kill the grass, however, for when an old pasture which was originally well set with it is plowed up the grass soon becomes vigorous again. It is quite possible to eradicate it without excessive labor or expense. When there is only an occasional small patch in the field it can be killed by hoeing thoroughly and then covering the surface of the ground with half an inch of common salt. When a large area of Johnson grass is to be destroyed it can be done by taking advantage of the fact that the rootstocks from which the new shoots are produced live only one year and that they are formed near the surface of ground which has not been plowed recently, especially if it has been heavily pastured. If the land is not plowed for a year the young rootstocks will all be found within 2 or 3 inches of the surface. By plowing shallow late in the fall when the weather is dry and following that by a thorough harrowing with a spring-tooth harrow which will drag the roots out of the ground, nearly all will be killed during the winter. This should be repeated in the spring and the ground planted in some hoed crop, like cotton or corn, and the few sprouts which may appear should be destroyed. The only expense is for the extra plowing and harrowing, and that is more than repaid by the additional crop which will be made as a result of the thorough working of the ground.¹

¹Cates, J. S., and Spillman, W. J. A method of eradicating Johnson grass. U. S. Dept. Agr., Farmers' Bul. 279, 16 p., 8 fig. 1907.

SUDAN GRASS.¹

Sudan grass is very similar to Johnson grass in appearance but is strictly annual in its growth, does not reseed the ground on which it is grown, and so can be used in rotation with other crops. It is grown principally as a hay and soiling crop, though it gives abundant and excellent grazing until destroyed by trampling or killed by frost. It will grow on almost any soil which is not too wet, and it bears drought with little injury.

Sudan grass is sometimes sown broadcast, but does best when planted in drills and given one cultivation early in the season and another after each cutting. It is also better to plant it in drills when the crop is to be grazed, as the grazing animals usually walk between the rows and so do not trample the plants. The drills should not be more than 12 to 18 inches apart. In sections suited to its growth Sudan grass yields from two to four cuttings of 1 to 2 tons each, and the hay is of excellent quality.

Though it bears severe drought without injury it is greatly weakened and injured by excessive rains and so is not well suited to cultivation in Florida and along the immediate Gulf coast westward to Texas, but in the central and northern portions of the cotton region and in the dry climate of Texas and westward Sudan grass is one of the most valuable and productive grasses of recent introduction.

DALLIS GRASS.

Dallis grass² is known also as golden-crown grass, *paspalum*, large water grass, and smooth *paspalum*. It came originally from Argentina and has become thoroughly established in all the cotton region where the soil is fairly heavy and somewhat moist. It does not thrive well on very dry or very sandy soils, but is most abundant on the creek bottoms and low lands from South Carolina westward to Louisiana. It is a perennial which makes a continuous growth during warm weather, is not injured by close grazing or by moderate frosts, and so has great value as a pasture plant for both summer and winter. When the plants are scattering it is inclined to grow in rather large clumps and therefore is better for grazing, but when it occupies the ground fully the clumps are small and the growth nearly erect. The grass seems to make its best growth in central and northern Georgia, Alabama, and Mississippi and is sometimes cut for hay. The land on which it is grown may be mowed twice during a season, the first cutting in May being largely of vetches and mixed grasses, and a second and better cutting in midsummer, when the yield may be as much as 2 tons per acre. The hay is of excellent quality and sells readily on the local market.

¹ Vinall, H. N. Sudan grass as a forage crop. U. S. Dept. Agr., Farmers' Bul. 605, 20 p., 10 fig. 1914.

² *Paspalum dilatatum*.

Dallis grass is rather difficult to propagate, as it does not spread by runners, and a large part of the seeds fail to mature in good condition. The best seeds are usually those which ripen late in the season, and during October and November a limited supply may be obtained from the scattering plants which are found on nearly every farm. Those who cut the grass for hay often secure seed from the refuse in the bottom of the mow, though much of the seed collected in this way fails to grow. Fortunately, the grass is very hardy, and when a few plants have become established in a field it will spread slowly over the richer part of the ground. It never becomes a weed and is rarely seen on cultivated ground. American seed is not often found on the market, and much which is sold as Dallis grass is seed of purple water grass, or purple paspalum, an annual and almost worthless species. Australian seed is expensive and not high in germination. This grass is one of the best for winter grazing in the South, and it is well worth while to establish it on every farm south of Tennessee and North Carolina. The seed may be sown broadcast at any time during the late fall or winter, after which the ground should be disked or harrowed, though a fair stand is often obtained by scattering the seed over the field and giving it no further attention.

VASEY GRASS.

Vasey grass,¹ sometimes called bull-grass, is very similar to Dallis grass, but is taller, strictly erect, and less leafy. It was long since accidentally introduced from Argentina and has now become quite common in all the southern part of the cotton region, being most abundant in southern Louisiana and Mississippi and in some parts of Florida. It does best on low ground which is usually moist and often makes a heavy growth on ground which needs to be drained to produce a thrifty growth of most other crops. It is more valuable for hay than for grazing, as it does not bear frost as well as Dallis grass. It makes a heavy yield of hay, which is of very good quality and finds a ready sale in the New Orleans market.

Vasey grass is propagated by seeds only, and as there are no seeds now on the market the only way to provide for its increase is to gather seed by hand in old fields where it is now growing and sow in the fall on the fields where it is wanted. It spreads well by self-sown seeds, and when it has once become well established in the upper part of a creek bottom it soon spreads to the lower parts. It never becomes a troublesome weed, being easily eradicated by a single plowing.

PARA GRASS.

Para grass, which is probably native to South America, is now common in most of Florida and to a considerable extent farther

¹ *Paspalum larranyagai* or *P. vaseyanum*.

west, especially in southern Texas. It is best adapted to Florida, and the Gulf coast, though it survives the winters as far north as Charleston, S. C. It is a rank-growing perennial, spreading by runners, often 30 or more feet in length, which form roots at each joint that touches the ground. As soon as the ground becomes fairly well covered with these runners, erect or ascending branches are produced, reaching a height of 2 to 4 feet or more and making a heavy yield for either hay or grazing. Although Para grass spreads so rapidly by its long runners, it is more easily killed than Bermuda grass or Johnson grass, as the runners are wholly above the surface of the ground and can be destroyed by a single shallow plowing late in the fall followed by a thorough harrowing. In regions where heavy frosts occur plowing will kill it if the work is done at the beginning of the cold weather. Though it makes a fair growth on moderately dry soil it does much better where the ground is wet and on the margins of ponds often reaches to where the water is 3 or 4 feet deep. It is a desirable species for planting on lands liable to overflows, as it is scarcely injured when covered by water for a month or more.

Para grass produces little good seed and is usually propagated by divisions of the runners. These root readily if cut into pieces of two or three joints each and pushed into freshly plowed ground so as to leave the upper joint just at or a little below the surface. When sets are abundant it is better to put them about 2 feet apart. Planting may be done at any time from early spring until about three months before frost is expected. This grass makes a rather coarse hay, but is sweet, tender, and nutritious, and the yield is very heavy. One Texas grower reports 4 tons per acre from each of two cuttings on a 12-acre irrigated field and that a third crop, equally heavy, was grown but was not cut on account of an early frost. Florida growers make three to four cuttings annually, and the hay finds a ready market at a good price. Para grass is also excellent for pastures when not grazed too closely. One field of 10 acres in southern Texas gave grazing for 15 cows from May to November, and at the close of the season the grass was fully 2 feet tall and appeared to be growing faster than it was eaten, though the field had not been irrigated during the preceding 18 months. A grower in southern Mississippi reports equally good results from a planting made on low rich land and very poor results when planted on dry clay. A field which is well set with the grass may be kept in good condition almost indefinitely if it is given a shallow plowing in the spring and then seeded with cowpeas. The grass will make a vigorous growth and the first cutting will be ready when the peas begin to mature, the mixture making a hay of choice quality and a better yield than when the grass is grown alone. The pea vines will make no further growth, but the

grass will yield two to four later cuttings, each heavier than if the ground had not been plowed.

Some of the Florida orange growers who have it thoroughly established in their groves complain that Para grass makes cultivation difficult and that it is seldom advisable to allow it to gain a foothold on land which is to be cultivated. In Cuba and in the extreme southern part of Florida, where the rainfall is heavy and frosts are rare, it may be a dangerous weed, but it is easily killed wherever moderate frosts occur and in irrigated regions by withholding the water a short time. It is killed to the ground by heavy frosts and is not recommended for planting where the temperature falls below about 18° F.

CARIB GRASS.

Carib grass¹ is very much like Para grass in appearance and manner of growth, though the runners are not as long and it makes a better, nearly erect growth. It needs the same soil and treatment and is propagated in the same way. Though it apparently produces seed abundantly, the seeds are usually defective and will seldom germinate. Carib grass seems to be slightly less resistant to cold than Para grass and so can be grown hardly so far north. Where both can be grown it makes a heavier yield and a finer hay than Para grass. It makes heavy yields in central and southern Florida, in southern Louisiana, and in the irrigated region along the Rio Grande in southern Texas.

GUINEA GRASS.

Guinea grass, a native of Africa, is now a common grazing grass in Cuba and other West Indian islands, whence it was introduced into Florida as early as 1870. Though very different in appearance and habit of growth, it has often been confused with Johnson grass, which has been called by the same name. Johnson grass spreads by long fleshy underground branches and has large seeds, which are red, yellow, or nearly black, and Guinea grass grows in dense, erect clumps, does not spread by rootstocks, and has small seeds which are dark green. The leaves of Guinea grass are never streaked with red or yellow, as those of Johnson grass often are. Anyone who notes any of these characters will never mistake one grass for the other.

Guinea grass grows to a height of 6 to 12 feet and is useful principally for soiling. Its range of profitable cultivation is about the same as that for Para grass, including the whole of Florida and a narrow strip westward along the coast south of latitude 31°. It has been grown successfully near Mobile for some years and matures an abundance of seed both there and in southern Mississippi. It is very promising in the few localities where it has been tried in southern Texas. It does well on moderately dry soil and can never become a

¹ *Eriochloa subglabra*.

pest like Johnson grass. It is propagated by divisions of the roots or by seeds. When roots are used the old clumps should be dug out early in March and divided, a single stem with a few good roots being sufficient for a set. If planted about 3 feet apart in rows 6 feet wide the young plants will give a good cutting in May. Seeds are planted at the same season as the roots, the usual practice being to plant them in drills and then to transplant the seedlings when they are 3 or 4 inches high. Volunteer seedlings are usually found in abundance where the old plants have been allowed to mature seed. Sets are more expensive and troublesome than seedlings, but will give an earlier and heavier yield the first season.

When the crop is to be used for soiling and heavy yields are expected the ground should be occasionally cultivated and a dressing of cottonseed meal given just before each cultivation. The grass begins its growth rather late in the spring, seldom giving much feed before May, but after that time it will give good cuttings once every three or four weeks until its growth is stopped by frost. In the most favorable part of the season cuttings may be made every 10 or 12 days, though such a rapid growth is maintained for only a few weeks. The grass makes the best feed if cut when 18 to 24 inches high. If allowed to stand too long the stems become hard. It is difficult even to estimate the yield per acre, as the grass is used principally for soiling, its habit of growing in large clumps making it difficult to cut for hay. One grower, who has used it many years for soiling, reports that he can feed four head of cattle per acre through the entire season, while another, who is raising cattle extensively, reports that he grazes three head per acre through the entire year, but adds that he also gives a little Para grass hay in the winter. It does not bear frost well and is often killed by a temperature of 25° F.

RHODES GRASS.¹

Rhodes grass is a perennial with very leafy, slender, erect stems, 3 to 5 feet tall, and very long and narrow leaves. It seeds freely at the tops of the stems in clusters of 10 to 20 spikes, 3 to 4 inches long. In addition to the erect seed-bearing stems, it produces numerous prostrate runners, which are often 6 to 8 feet in length and take root at every joint where they rest on the ground, so that even where the original stand is thin these runners soon cover vacant spaces of considerable size. They serve not only to spread the grass, but also to establish a constant succession of new plants, more vigorous and productive than those which are older. Although the grass seeds freely and also spreads by runners it is easily controlled and rarely becomes troublesome as a weed.

¹ Tracy, S. M. Rhodes grass. U. S. Dept. Agr., Farmers' Bul. 1048, 16 p., 3 fig. 1919.

Owing to its inability to withstand severe cold, Rhodes grass is not grown north of Florida, the immediate Gulf coast, and southern Texas. In Florida it is grown principally from St. Augustine southward along the east coast, from Brooksville southward along the west coast, and in a good part of the Everglades region. Probably more than half the total acreage in this country at the present time is in Texas, from Houston and San Antonio southward to the Rio Grande, and there it has become the practice to have one or more acres of it for a feed and pasture lot near the stable on every farm and ranch. It rarely survives the winter where the temperature falls below 15° or 18° F., and on that account it is sometimes grown as an annual in regions of colder winters, as it will then give two or three cuttings of about 1 ton each during the summer and fall; but at the present price of seed that is seldom profitable.

Rhodes grass does best on a soil which is fairly moist, although it will live and make some growth during several months of drought. A deep, rich loam is best suited to it, and it is likely to be unsatisfactory on dry, hard clay or on dry sandy soils. It grows vigorously on the well-drained peaty soils of Florida, on the reclaimed muck soils of southern Louisiana, on the heavy irrigated lands of southern Texas, and on the black-wax soils wherever there is a moderate amount of rainfall or where irrigation is available.

Early in the spring, when the soil is in a proper condition and there is no further danger from late frosts, or in late summer the ground should be well plowed and then harrowed until the surface is fine and even. Too much stress can not be put on the importance of thorough preparation. As the seed is often low in germination and the young plants are weak until they become well rooted, it is poor economy to risk the securing of a full stand by withholding a little work in preparing the field. The most successful growers in Texas recommend that the ground be prepared by irrigating, plowing, double disking, harrowing, seeding, rolling, and then another irrigation. Florida growers, who are not obliged to irrigate, recommend plowing, harrowing, smoothing with a plank drag, seeding, and then rolling the heavier soils or using a weighted plank drag on those which are more sandy. The important point in seeding anywhere is to have the soil sufficiently moist to germinate the seed quickly and then to maintain this moisture until the young plants become well established.

The quantity of seed needed varies with its quality and with the condition of the land. When the land is in good condition and well-cleaned seed is used, from 7 to 8 pounds per acre are sufficient, and some planters use much less. From 2 to 3 pounds are sufficient where a press drill is used on well-prepared soil.

The seed is usually sown broadcast, the work being done on a still day, so that the wind will not interfere with an even distribution.

After the seed is sown it should be covered very lightly. In regions of abundant rainfall a light harrowing or covering with a plank drag is usually sufficient, although if that is followed by a rolling it will be better. In Texas and other dry regions the use of the roller is much more important, as it is necessary to compact the surface of the soil so as to conserve all the moisture possible. If the soil is not fairly moist when the seed is sown, it should be irrigated immediately. The seeds germinate rather slowly, and as young plants are weak they should not be allowed to suffer from lack of moisture before they have become well established.

Under favorable conditions the crop is often grazed within a month after seeding, and frequently it will give a fair cutting for hay in two months, though the first cutting is likely to be somewhat weedy.

The yield of Rhodes grass hay varies greatly with the character of the soil and the length of the growing season, and still more with the amount of moisture in the soil. Cuttings should be made as soon as the seeds begin to ripen, and in arid regions each cutting should be followed immediately by an irrigation, so as to secure a new growth as quickly as possible. Little new growth is made after cutting until the soil is well moistened. From three to six cuttings usually can be made during a year, about five weeks being sufficient for the growth of a hay crop when all conditions are favorable. When Rhodes grass is grown on thin sandy or clay soil with only a moderate amount of rainfall or with insufficient irrigation, the yield may be only 1 or 2 tons per acre, while on the soils best suited to its growth and well supplied with moisture the yields are often 8 tons or more.

The quality of hay made from Rhodes grass is superior to that of hay made from most other grasses, in that it contains a larger proportion of leaves, while the stems are slender, tender, and sweet, so that the hay is eaten with very little waste. Horses, mules, and cattle eat it with great relish. It retains its color well in drying, therefore making an attractive-looking bale for the market.

Rhodes grass was first cultivated on account of its value for pasture. In regions where this grass can be grown, the grazing season lasts through the entire year, though, of course, the quantity of feed produced is much less in cool weather than during the summer.

NATAL GRASS.¹

Natal grass, from South Africa, resembles crab-grass in its manner of growth, but produces a better quality of hay and on soils which are very sandy a much heavier yield. It is an annual,

¹ Tracy, S. M. Natal grass: A southern perennial hay crop. U. S. Dept. Agr., Farmers' Bul. 726, 16 p., 4 fig. 1916.

but reseeds the ground so freely that its growth is practically continuous on suitable land where it has once been grown and which has been given the proper cultivation.

When a single plant of Natal grass is allowed abundant room it will form a large tuft, sometimes 3 to 4 feet in diameter. The lower branches soon become decumbent, while the central stems are more nearly erect. When planted closely, however, the tufts are much smaller, often making only a few stems and those nearly erect. The stems are slender, 2 to 4 feet high, and well covered with leaves, which are so nearly erect that few are lost in mowing the hay.

Natal grass makes its principal growth in middle and late summer and is usually grown in rotation with some winter or early-spring crop. It is one of the best grasses for soils which are very sandy and dry, as on such soils it reseeds the ground for succeeding crops, which it does not do when grown on heavy or wet soils, where other grasses, such as Para, Carib, or Bermuda grass, are usually more profitable.

Natal grass is grown more largely in central and southern Florida than elsewhere and is commonly used as a catch crop to follow winter crops of vegetables and as a cover crop in citrus groves. It will give two or three cuttings of three-fourths to 1 ton each during a season and makes a hay of desirable quality.

CRAB-GRASS.

Crab-grass is of considerable importance as a volunteer hay crop, especially on sandy soils. It makes its growth late in the season on lands from which early crops, such as oats, melons, or potatoes, have been taken and often makes a good growth in fields of cowpeas, where it adds largely to the yield of hay. The crop should be cut early, soon after the first seeds begin to mature. It is somewhat difficult to cure, but when well handled at the proper stage of growth it makes a hay of good quality. It is always a volunteer crop and need never be sown.

KIKUYU GRASS.

Kikuyu grass,¹ recently introduced from Uganda, Africa, has leaves and creeping stems much like those of carpet grass, though much larger and more succulent. It makes a very dense growth, the first growth being erect, but when the stems reach 15 or more inches in height they become very decumbent at the base, matting down so that the lower leaves soon die; hence the grass is not well suited for making hay. It bears frost about as well as carpet grass, is much more vigorous and productive, is eaten greedily by horses, cattle, and hogs, and promises to be of great value as a pasture

¹ *Pennisetum longistylum*.

grass. It has been planted in many places in Florida and westward to Texas, and most reports of its growth have been favorable.

As kikuyu grass does not make seed in this country it must be propagated vegetatively, like Bermuda grass. The cuttings should be planted in spring on good soil which is not too dry, setting them 2 to 3 feet apart, so that the ground will be covered quickly. After it becomes established the grass should be grazed so close that no stems will be long enough to fall down and smother the new growth.

While the introduction of this grass is too recent for its true value for pastures to be fully demonstrated, it has done so well wherever tested that it is well worth extensive trials.

MAIDEN CANE, OR PAILLE FINNE.¹

The grass known as "maiden cane" in Florida and along the South Atlantic coast and as "paille finne" or "pifine" in Louisiana is a species which is native to those regions, but is rarely seen elsewhere. In Florida it is very abundant in the Everglades region and northwestward to Tallahassee, and it is also abundant on the low mucky soils of the Atlantic coast as far north as Charleston, S. C. In Louisiana its growth is confined almost entirely to the region west of the Mississippi River and south of the Southern Pacific Railroad, where it is most abundant on lands only 2 or 3 feet above the ordinary water level in the neighboring bayous and canals. It is rare on salt marshes or on timbered lands.

If cut when the growth is young, maiden cane makes a hay of remarkably high feeding quality, but if allowed to stand until the stems become woody it has little value. Probably a third of the land on which it is growing is sufficiently high and dry so the grass can be cut with a mowing machine and handled like ordinary hay, but a great part of the natural meadows are too low and wet for the use of machinery, so the mowing must be done by hand and the hauling by drags, which make the hay expensive. Nearly all of the land on which the grass is growing, however, is so high that it can be drained easily and so be made available for permanent meadows, which will give from three to five annual cuttings, averaging fully a ton each. Lands which have been cut over annually for several years show no decrease in yield, so the grass seems to be practically permanent.

Planters who have used maiden cane are almost unanimous in regard to its high value for grazing. In southern Louisiana it is extremely profitable to buy feeders from northern Louisiana, the New Orleans stock yard, or other places, put them on the paille finne pastures for feeding and fattening, and then market them within six months without having given them a pound of any grain feed,

¹ Tracy, S. M. Paille finne grass. La. Agr. Exp. Sta. Bul. 147, 7 p. 1914.

the pasture alone being sufficient to put the animals in good marketable condition. In many such cases the net profits have been from 50 to 100 per cent.

As the grass rarely produces seed it can be propagated only by planting the slender rootstocks, which are produced very freely. That method, however, is so slow and expensive that it will seldom be profitable, though the grass is one which has great value where it grows naturally.

ORCHARD GRASS.

Orchard grass seldom makes a heavy yield of hay in the cotton region, but it is an excellent pasture grass on wet and heavy soils in the northern part. It is a perennial which begins its growth very early in spring, and it furnishes good grazing until checked by the summer drought. With the first autumn rains it starts a new growth of leaves, making rich fall pasturage and remaining fresh and green through the winter if the cold is not too severe. Hay made from it is of excellent quality, though its habit of growing in large clumps is against its use as a hay grass. It bears grazing well and recovers quickly when cropped down. It does well when mixed with redtop and succeeds better than almost any other grass in woodland pastures. Sandy soils are not suited to its growth, and it can not be recommended for any light or thin lands.

RYE-GRASSES.

Two species of rye-grass, Italian and perennial,¹ are commonly cultivated. The former, while not truly an annual, is agriculturally treated as such. It makes a more rapid and usually a larger growth than the latter. Both are quickly injured by excessive heat or drought and so are not suited for permanent meadows or pastures, but as they make a quick and vigorous growth soon after planting they are valuable where immediate results are wanted. They are especially desirable for sowing with redtop and other slow-starting grasses. If sown in the fall they will give rich late winter and spring grazing, or they may be cut for hay in April or May, after which they soon disappear. It is important that the crop be cut as soon as well grown. If that is not done the warm rains of June and July will cause the leaves to decay very rapidly and smother the small plants of other grasses which may be growing on the same ground. On rich alluvial land these grasses often persist two or three years when used for hay, but seldom last more than one year when grazed. They are among the best of grasses for planting on newly made lawns, as they soon cover the ground and give it an attractive appearance while the Bermuda grass and other slower starting sorts are becoming

¹ *Lolium multiflorum* and *L. perenne*.

established. Seed should be sown in October or February, at the rate of 20 to 30 pounds per acre when sown alone or half that quantity when sown with other grasses. Italian rye-grass is becoming more and more used for fall planting on the sandy coast lands. It makes a much better pasture or hay than rye.

REDTOP, OR HERD'S-GRASS.

While redtop is seldom used alone for either hay or grazing it is an important factor in both meadows and pastures. It is slender in growth, and the yield is not large, though the hay is of good quality. It makes its best growth on soils too poorly drained for most other crops and therefore is important on all wet lands. Redtop is a perennial which bears frost well and so gives winter grazing. It does better on wet clay soils than on those which are sandy and has little value for dry uplands. It is one of the best kinds for creek banks, the margins of swamps, overflowed lands, and similar places where Bermuda grass, bluegrass, and other upland kinds can not be grown. On the rice lands of South Carolina it succeeds better than any other tame grass. Seed may be sown in either fall or spring at the rate of 6 to 10 pounds of re-cleaned seed per acre. The growth is usually weak the first year, but it gains vigor with age and holds the ground well against other grasses.

KENTUCKY BLUEGRASS.

The northern limit of the cotton region is nearly the same as the southern limit of the bluegrass country, though Kentucky bluegrass does well in some places from North Carolina westward to Arkansas, especially in the valleys of the limestone country. It is seldom used for hay, as its growth is too short and the yield too light, but where it can be grown it makes excellent pastures. It succeeds best on a rich lime soil which is clayey rather than sandy and is well drained without being too dry. It makes its best growth in fall and spring and remains green through the winter, but suffers severely in long-continued hot weather, and so is not suited for use in the extreme South.

RESCUE GRASS, SCHRADER'S GRASS, OR AUSTRALIAN OATS.

Rescue grass, Schrader's grass, or Australian oats, is sometimes highly valuable and at other times disappointing. When planted on a very rich loamy soil and the season is favorable it makes a heavy winter growth, which affords fine grazing from December to April or a heavy yield of hay in early spring and often a second cutting later. If the conditions are not favorable it may not begin its growth until late winter, only a poor stand will usually be secured, and its growth will be weak and unsatisfactory. It disappears on the ap-

proach of hot weather, but a few of the plants will live through the summer and with the scattered seed will often make a good volunteer growth the following season. Its growth and behavior are so uncertain that it is a reliable hay plant in only a few localities, but its winter growth makes it a desirable addition to pastures, especially for mixing with orchard grass, bur clover, and vetches.

TIMOTHY.

Timothy has little value in the cotton region except in the extreme northern section, as it makes almost no second growth after being cut, the corms at the base of the stem being injured or killed by exposure to the hot sun through the long summer. If sown in the fall or in early spring it will give one profitable cutting and then almost wholly disappear. A few alfalfa growers practice sowing timothy with the alfalfa seed in September, as it does much to occupy the ground and prevent the growth of crab-grass until the alfalfa is strong enough to protect itself, besides giving one good cutting for hay in early spring. Italian rye-grass is, however, preferable for this purpose. Timothy can not be recommended for general cultivation in any part of the cotton region.

MILLETS.¹

The millets which are of greatest value in the cotton belt are those belonging to the foxtail group, of which there are several well-marked varieties, differing mainly in size of plant and length of season required for their growth. Common millet is the smallest and hardiest form, ripening earlier and growing on poorer soils than either of the others, and making a finer and better hay, though even when grown on rich soils its yield is not as heavy as that of German millet. It requires 45 to 50 days from seeding to cutting and is probably the best variety for growing on soils which are thin and dry.

Hungarian millet when grown on good soil yields more heavily than the Common, though it does not bear drought as well. It requires 50 to 60 days from seeding to cutting.

German millet is larger and coarser than either of the other varieties and requires a richer soil, with an abundant supply of moisture. It is much the largest of the three foxtail millets, has a rather coarse stem with very large and usually drooping heads, and produces a large amount of seed. The hay is so coarse that it is less valuable than that from the others, but the crop is excellent for feeding while green, and its yield is so heavy that it is of special value for soiling. By making sowings at intervals of two to three weeks from May to July it is easily possible to have a good succession of soiling crops

¹ Vinall, H. N. Foxtail millet: Its culture and utilization in the United States. U. S. Dept. Agr., Farmers' Bul. 793, 28 p., 10 fig. 1917.

from July until September, just at the time when such crops are most needed. German millet requires 60 to 75 days from seeding to cutting. This is nearly or quite the same as is the variety known as Golden millet.

All of these millets require warm weather for their growth, and as all of them are very shallow rooting the surface of the soil should be made very fine and smooth before the seed is sown. From 2 to 3 pecks of seed per acre should be used and may be sown either with a drill or broadcast. The sowing should be followed by rolling if the ground is very dry.

The cutting for hay should be made as soon as one-fourth to one-half of the heads of the millet are out of the "boots." If allowed to stand until fully headed the stems become hard and unpalatable and are less digestible, the beards become so harsh that they sometimes cause irritation in the stomach, and the hay is much less valuable than when cut earlier. When cut at the proper time the hay is of excellent quality, though it should be used with some other feed when given to horses and mules, as when fed alone, especially if overripe, it sometimes causes increased action of the kidneys, lameness, and swelling of the joints. When cut at the proper time millet may be used with safety for at least half the feed for horses and mules and may be fed without limit to cattle.

It sometimes happens that, owing to unfavorable weather or a press of other work, it is impossible to cut millet in the right condition for making good hay. In such cases it is better to let the crop stand until the larger part of the heads are mature and then harvest it for seed, cutting, binding, and thrashing it like wheat or oats. The seed is always in demand at a good price, and the stems are so broken and torn after thrashing that they make a feed of fair quality for cattle.

There are few other crops from which as much hay of equally good quality can be made in so short a time. Some growers object to the crop because it is hard on the land, but there is little foundation for that claim. The crop is usually cut during the hot and dry weather of August and September, and when any soil is suddenly left bare at that season the ground is sure to bake and become hard very quickly. If the ground is wanted for immediate use it should be plowed within a day or two after the millet is taken off, as it will be very hard to work a few days later. If, however, it is not needed for some time it should be let alone, and after the fall rains have softened the surface it will plow as easily and be as mellow as ground on which any other summer crop has been grown.

Millet is not recommended for the principal crop of hay, for it is not as good as some others, but it is one of the best for use in an emergency when a hay crop must be made during two or three months in summer when the ground would otherwise be idle, and it is also

one of the best that can be grown for green feeding during the dry weeks of the late summer.

COLORADO GRASS, OR TEXAS MILLET.

Colorado grass, or Texas millet,¹ is valued highly for a late hay crop on the river-bottom lands of southern Louisiana and Texas, where it is native. It is an annual, growing from 2 to 4 feet tall, very leafy, and valuable for both hay and grazing. It prefers rich alluvial soils, where it volunteers, like crab-grass, but it does not grow well on dry uplands. Like crab-grass, it should be cut early before the seeds have matured, when it makes excellent hay. If left until fully ripe the stems become hard and a large part of the seed is lost. It has not succeeded well on the Atlantic coast or in the northern parts of the cotton region, but seems especially adapted to the river-bottom lands of southern Louisiana and Texas. The seed may be sown at any time during the early summer at the rate of 40 pounds per acre, and when one crop has been grown the land will not need reseeding the following year.

CEREAL GRASSES.

Wheat, oats, rye, barley, and to some extent rice are used both for winter pastures and for hay. All except rice are usually sown in the fall, as they then give good grazing through the latter part of the winter. If the animals are taken off just before the stems begin to shoot, a fair crop of hay can be made by cutting the wheat when it is in the milk stage and the oats when a little riper. Spring-sown oats also make fine hay, but usually do not yield as well as those sown in the fall. If wanted especially for grazing, the varieties known as Myers Turf and Gray Virginia are excellent, while the Texas Rust-proof is more popular for hay. Rye and barley make poor hay, but are excellent for winter and spring grazing. For most winter grain crops about 1½ bushels of seed are used per acre; for oats the quantity of seed is usually a fourth or a half greater. Good hay is made in many places from the rice fields which have been cut for the grain. Such fields usually make a considerable second growth of rice and may even head well, but seldom mature good seed. The land on which such hay is made must not be flooded while the second growth is coming on, or the leaves will become covered with sand and mud and make the hay dangerous for feeding.

COARSE FODDER GRASSES.

Several important southern forage crops are closely comparable with corn in habit, and as a consequence the methods of culture are similar. Like corn they may all be used for pasture, soiling, silage,

¹ *Panicum texanum*.

or dry fodder. These plants are sorghum, teosinte, Japanese sugar cane, and Napier grass. The first two are annual, the others perennial.

SORGHUM.¹

Sorghum is extensively grown in the cotton region for soiling, silage, and hay. The varieties are numerous, but the principal ones used in the South are the sweet sorghums, especially Orange, Amber, Red Amber, Sumac, Honey, and Gooseneck. The grain sorghums are not so desirable, as all or most of the seeds are destroyed by the sorghum midge. The crop is remarkable for its ability to withstand severe periods of drought and therefore is extensively grown in semiarid regions.

Sorghum should be planted as soon after corn as the ground is thoroughly warm. Where the season is long it may be sown from this date to as late as will permit the crop to mature safely, but if two cuttings are desired a comparatively early seeding is necessary. Sorghum may be sown either in a furrow with a lister or in the surface soil with an ordinary corn planter. Sumac sorghum can be sown either in rows the same distance apart as Indian corn (36 to 44 inches), sown broadcast, or drilled in with a grain seeder. Sowing in rows is usually advisable, as it gives a larger yield. If seeded in cultivated rows, 4 to 6 pounds of seed to the acre will be found ample. If sown broadcast or with a grain drill, 1 to 1½ bushels of seed per acre usually give the best results except in the very dry sections, where 2 to 3 pecks are better. Broadcast seedings should be thick enough to keep the stalks fine.

The crop should be harvested for forage purposes when in the late milk stage. Where a seed crop is desired, cutting can be delayed until the seed is in the late dough stage without materially decreasing the feeding value of the fodder. To some extent the time of cutting can be regulated by weather conditions. When grown in cultivated rows it is most efficiently and economically harvested with a corn binder and put in shocks of 20 to 30 bundles each. The corn harvester is also serviceable if the crop is to be used for silage. If sown broadcast or in close drills it is often cut with a mower and cured like other hay crops. This method is undesirable, because the sorghum is hard to cure and difficult to handle with a fork. A better method is to cut it with an ordinary wheat binder and allow the bundles to cure in shocks.

Sorghum cut with a corn harvester can be stored in the barn after it is thoroughly cured, or it can be stacked in the open. Sorghum in bundles or as loose hay turns the water well, so that there is small loss from spoiling in the stack.

¹ Warburton, C. W. The nonsaccharine sorghums. U. S. Dept. Agr., Farmers' Bul. 238, 28 p., 9 fig. 1907.

Properly cured sorghum hay is excellent on account of its leafy character. All live stock eat it greedily, the large amount of sugar in the stems making it quite palatable. For silage purposes it is practically equal to corn. If cut for silage when the seed is nearly hard, no trouble from spoiling will be experienced.

Sorghum fodder or hay is an excellent roughage and in many localities is practically the only kind used. For milk cows and work horses 12 to 18 pounds a day, if supplemented by the ordinary quantity of grain, are sufficient. Sorghum roughage will be much more effective in fat production if, in connection with it, a small amount of some concentrate high in fat, like cottonseed meal, is given the animal. Cattle and horses are often carried through the winter without the use of grain by feeding them liberally with sorghum fodder.

Sorghum is often pastured, especially to hogs. Cattle are sometimes poisoned when pastured on second-growth sorghum late in the fall, but cases of this kind have been much less frequent in the South than in the North.

TEOSINTE.

Teosinte is similar in habit to corn and requires a long season of warm weather, a rich soil, and abundant moisture in order to succeed well. It is useless to plant teosinte where all these conditions can not be had. It is a remarkably vigorous grower, reaching 10 or 12 feet in height, with an unusually abundant supply of leaves and slender stems which continue to grow until killed by frost. It is planted and cultivated like corn, and if cut when it reaches 4 to 5 feet in height makes excellent fodder and will produce a second cutting fully as large as the first. If left to grow until September or October it furnishes excellent material for the silo in greater quantity per acre than either corn or sweet sorghum. It is also one of the best plants for soiling purposes. The plants stool freely, sometimes as many as 50 stalks growing from a single seed; its leaves are similar to those of sweet sorghum, but much longer, and the stalks contain 8 to 10 per cent of sugar. Its growth is very rank, the Louisiana Agricultural Experiment Station reporting a yield of more than 50 tons of green feed per acre on rich alluvial soil. Its season of growth is so long that it seldom matures seed north of latitude 30° N., but it has ripened well at the Florida and Louisiana experiment stations. The seed, 4 to 5 pounds per acre, should be placed in hills 4 to 5 feet apart each way at about the time cotton is planted. The greater distance should be given on the richer soils. On lands of only moderate fertility sweet sorghum is much to be preferred.

JAPANESE SUGAR CANE.

Japanese sugar cane is similar in habit of growth to the ordinary sugar cane of Louisiana, but the stalks are more slender and the stools larger; it also stands more frost and needs replanting less frequently. It is propagated by planting sections of the matured canes in the same manner that the Louisiana sugar cane is propa-



FIG. 2.—Japanese sugar cane, full grown, in Mississippi.

gated, and its cultivation is practically the same as that needed for corn. It may be planted in either fall or spring, fall planting being preferable, as that gives it an earlier and better start in the spring. It is planted in rows about 6 feet apart, the rows being opened by running two furrows to throw out the earth and to make a shallow trench in which the canes are laid lengthwise and covered

by throwing the furrows back. When an abundance of canes can be had for planting it is better to lay two canes side by side the entire length of the row, breaking joints, and so securing an even and perfect stand. When canes are scarce only a single line need be used. In some cases, if the canes are very large and the ground in fine condition, good success is obtained by cutting the canes into pieces of three or four joints each and planting them 2 feet apart.

On fairly rich soil Japanese sugar cane continues to make good yields for many years, though the soil must be frequently and heavily fertilized for continuous high yields. On good soils it makes 40 to 60 tons of green feed per acre, and many growers prefer it to sorghum for cows and hogs. The leaves are killed by moderate frosts, but the stalks remain sweet unless actually frozen and can be kept in good condition through the winter by windrowing. When canes are windrowed for keeping them through the winter they are cut, and those from four rows are laid lengthwise in the central space and covered with sufficient soil to protect them from freezing. Care should be taken that the windrowing is done before the canes are injured by frost and that the windrows are placed on ground so well drained that water can not stand about the buried canes. In northern Florida the canes are often left standing in the field until the new growth starts in the spring, being cut only as wanted for feeding. In addition to its use as a forage plant Japanese sugar cane is often used for making sirup, a grower in central Mississippi reporting a yield of 750 gallons per acre, though the Louisiana cane is usually preferred for that purpose in localities where both can be grown. It is grown quite commonly in Florida and from central Georgia westward to central Mississippi. Its cultivation is extending westward through central Louisiana and Texas. (Fig. 2.)

NAPIER GRASS.

Napier grass is a plant of recent introduction which promises to be of great value for soiling, for silage, and for grazing. It is a perennial, growing in clumps like sugar cane and reaching a height of 15 to 18 feet. (Fig. 3.) The leafy stalks are numerous, sometimes a hundred or more in a clump where the plants are not crowded. The small seeds are produced in long and slender spikes, resembling those of cat-tail millet. The seeds germinate freely, but the usual method of propagation is by the use of the stalks, much as sugar cane is propagated. When well-matured canes are used for planting they may be cut to single joints, cutting about an inch below each eye. These pieces are planted by pushing them down into freshly prepared ground until the upper end of the piece is about level with the surface of the soil and the eye is down to where the soil is constantly

moist. Such planting has been done very successfully in Florida in November and December, but farther north spring planting, using two or three joints to each piece, has been more common. On very rich soil the hills should be about 6 by 6 feet, but on thinner soils they may be closer. The crop has been grown successfully as far north as Charleston, S. C., and has made heavy yields in southern Mississippi. When the canes are to be kept through the winter they should be windrowed like sugar cane.

Napier grass is of special value for soiling, as it is eaten greedily by cows, bears frequent cuttings well, and grows very quickly after being cut. When used for the silo it should be cut twice during the season, once before July when the stalks have reached a height of 10



FIG. 3.—Napier grass, 3½ months old.

to 12 feet, and again just before frost, as that will give a larger total yield and the silage will be of better quality.

Merker grass is a variety of Napier grass that differs in having a more slender and more glaucous stalk, more nearly erect, slightly narrower leaves, and more numerous spikes that ripen much earlier in the season. There seems to be little difference in yield or in hardiness.

LEGUMES.

Leguminous plants, those belonging to the pea and clover family, should be grown in every permanent meadow and pasture, as they make a large increase in the total yield, their mixture with the grasses makes the feed of better quality, and their cultivation in-

creases the productivity of the soil. Many of them are annuals and so can be used as catch crops. Some make their growth during the summer, others grow only during the winter, while still others are perennial and continue a vigorous growth for many years. Many of the annuals reseed the ground freely, and so are easily grown from year to year. Few of the perennial sorts bear grazing as well as some of the grasses, but some of the annual sorts are among the best of pasture plants. The hay made from legumes is especially valuable for young and growing animals, for animals which are being fattened, and for those which are not doing hard work. For hard-working animals, like livery horses and farm teams during the planting and cultivating season, hay made from grasses or a mixed hay is preferable to one made wholly from legumes.

The legumes are not only valuable for hay and pastures, but they are also the best plants which can be used for green manuring, which is of the highest importance in the cotton region, where the supply of humus and consequently of nitrogen in the soil becomes exhausted rapidly with the clean cultivation given to cotton and corn and the constant warmth of the soil. In few other parts of the country is green manuring more necessary or more profitable than in the South, and the growing of legumes provides a large part of the fertilizer needed for other crops. On this account some legume should be included in every system of rotation.

ALFALFA.

Alfalfa is undoubtedly the best legume for permanent meadows in localities where it will succeed, but it does well in only a small part of the cotton region. For its profitable growth it needs a rich well-drained soil containing an abundance of lime and having an open subsoil. Such soils are found in the black-prairie region of Alabama and Mississippi, in the alluvial regions along the Tennessee, Mississippi, and Red Rivers, in northeastern Texas, and in the Rio Grande region. Good alfalfa soils are also found on many river and creek bottom lands where the adjacent hills are of limestone. Alfalfa has not been satisfactory when grown on dry clay uplands; and on sandy soils it may make two or three good cuttings, but usually disappears before the end of its first year. It has not been grown successfully in the pine woods or in Florida and the Gulf coast region, where it may make a good growth in the spring, but is soon smothered out by crab-grass. Soils which are otherwise suited to its growth but are low in lime content may be made to produce good yields by an application of lime. The application should be liberal, not less than a ton of burnt lime or 2 tons of ground limestone per acre.

Seeding may be done from August to October or from February to April. Fall seeding is generally to be preferred, as weeds are then

less troublesome and a full crop can be obtained the next spring. On the black prairie soils of Alabama and Mississippi spring seeding is the almost universal practice. This is partly because the fall is usually a dry season, partly because weeds give little trouble on these soils, and partly because the alfalfa is often sown on land which was in cotton the previous season and could not be made ready in time for fall planting. A good preparation of the land for seeding is to grow a crop of cowpeas or soy beans during the previous summer. Before planting the cowpeas, the ground should be plowed as deep as possible and then harrowed smooth, that there may be no low spots where water will stand and in order that a mowing machine can run over it easily. As soon as the crop of cowpeas or beans is gathered, the ground should be disced or plowed very shallow and then harrowed until the surface is fine and mellow, after which the alfalfa seed is sown at the rate of 25 to 30 pounds per acre and covered by rolling or light harrowing. Deep plowing just before seeding is never a good practice, as it leaves the subsoil in such a loose condition that the plants are more easily thrown out of the ground by winter freezes and suffer more seriously in summer droughts. Heavy seeding, as above indicated, is always preferable in the South. One can not afford to imperil obtaining a full stand for the sake of saving a little seed. In many cases the crop rotation is such that seeding can not be done in the fall, as when cotton or some other late crop occupies the ground. In fact, some growers prefer to plant on old cotton land because of its freedom from crab-grass and other weeds. If such land is to be used it should be plowed deep as early in the fall as the cotton can be picked. If this fall plowing is impracticable the spring preparation should be a disking only, as young alfalfa plants do not bear drought well when the roots have not reached a firm subsoil. Deep plowing should not as a rule be done within three months of the time of seeding.

In all cases the soil should be inoculated with alfalfa bacteria. This is best done by the use of soil from an old alfalfa field. Soil from a bur-clover or a melilotus field will answer the same purpose. This inoculating soil should be scattered over the new field at the rate of about 200 pounds per acre just before the seed is sown and harrowed in immediately. Where inoculated soil can not be obtained, artificial cultures of the bacteria may be used. In this event it is advisable to plant but a small patch of alfalfa, as the cultures are not always successful and one is not warranted in taking the risk on a large field. If the small patch is successful it will furnish an abundance of soil for further inoculation. Land which has grown melilotus or bur clover within two years does not need inoculation. Most alfalfa fields, even those on soils containing considerable lime, are usually improved by an occasional top-dressing of lime.

When sown as early as August, alfalfa in a favorable season will often give a fair cutting of hay in December and may be expected to give three to six cuttings of about 1 ton each the following season, but if sown in the spring one or two cuttings are all that can be expected the following summer. Many planters use alfalfa for grazing hogs and find it very profitable. When a field is used for continuous grazing it requires care to keep it in good condition. It should not be overstocked late in summer or it will be seriously injured. In the spring and early summer a good field will carry 12 to 15 pigs per acre, or about 1,000 pounds, live weight, of hogs per acre, and the animals will make a fine growth. Later in the season the number should be decreased or all removed, so as to give the alfalfa a few weeks of rest. The pasture should be supplemented with a ration of at least 2 pounds of grain a day for each hundred pounds of live weight.

MELILOTUS.¹

Melilotus, or Bokhara clover, the white sweet clover of the North, is a close relative of alfalfa and is an important hay and pasture plant on soils which are rich in lime and are not of sufficient depth or are in too poor a mechanical condition for alfalfa or red clover. It is most abundant in the black-prairie region, where it makes a luxuriant growth, even in places where the lime rock is covered with only a few inches of soil. If cut while the plants are young, as soon as they begin to make flowers, the hay, except for its odor, can hardly be distinguished from alfalfa; and as it will give two or three good cuttings in a season it is a valuable hay plant. If, however, the plants are allowed to become too old and mature before they are cut, many of the leaves will drop, the stems will be hard and woody, and the hay of poor quality. It is also one of the best pasture plants for dry limestone hills, as it begins its growth early in spring and continues in an eatable condition through the entire season. After a field is once seeded it continues to produce two crops each season if undisturbed. In many parts of the country it is regarded as a worthless weed and is not readily grazed by horses or cattle, but it is not so in the South, where it grows on a soil unsuited to most other grazing plants and where it is eaten as freely as alfalfa or clover. Seed may be sown in September and October or in February and March at the rate of half a bushel of unhulled seed or 20 pounds of hulled seed per acre. Usually but one cutting for hay can be made the first season, but the second season it will commonly give three cuttings of 1 to 2 tons to the acre each. The roots are very large and grow deep, and as most of them die and decay at the end of the second year they leave the soil in fine condition for cotton or corn.

¹ Coe, H. S. Sweet clover: Growing the crop. U. S. Dept. Agr., Farmers' Bul. 797, 34 p., 11 fig. 1917.

— Sweet clover: Utilization. U. S. Dept. Agr., Farmers' Bul. 820, 32 p., 13 fig. 1917.

— Sweet clover: Harvesting and thrashing the seed crop. U. S. Dept. Agr., Farmers' Bul. 836, 23 p., 13 fig. 1917.

ANNUAL YELLOW MELILOTUS.

Annual yellow melilotus is closely related to white sweet clover, but it does not grow so large, has yellow flowers, and is an annual which reseeds the ground freely. It grows most abundantly on the alluvial soils near the Gulf coast, where it is often very abundant in old rice and sugar-cane fields, making its principal growth in late winter and early spring, at which time it is grazed freely. It makes a hay nearly or quite as good as alfalfa, but as it usually grows in cultivated fields which are too uneven or too wet for mowing it is seldom cut for that purpose.

Although it is seldom cultivated, it is everywhere a desirable volunteer crop, as it gives good grazing very early in the season and adds large amounts of humus and nitrogen to the soil.

RED CLOVER.

Red clover in the South grows best on the alluvial and black-prairie soils and is seldom profitable when sown on sandy pine-woods soil or on dry clay hills. It requires a moderately rich soil having a fair amount of lime and in good mechanical condition. On sandy soil, even where it makes a good start, it is usually choked out by crab-grass and other weeds before the end of the first season. Even on good soils it rarely lasts more than two years, but it yields so heavily and its hay is of such good quality that it is a profitable crop on all soils suited to its growth. Land should be prepared as for alfalfa and the seed sown early in the fall, not later than the middle of September in any part of the cotton region, so that the plants may become well rooted before winter. Red clover will then make a rank spring growth and give a heavy cutting, 2 to 2½ tons, in May, a lighter cutting in June, and in favorable seasons another cutting in September, though the last cutting may be very light in seasons of a long summer drought. The following April or May it will give another cutting nearly or quite as heavy as the first, after which the ground should be plowed and used for corn or some other crop, as few of the clover plants will live through the second summer. When sown in the spring the yield will be very light the first year, the first cutting being principally of volunteer grasses and weeds, though one or two fair cuttings of the clover may be made later and a heavy cutting the following spring, but the total yield from the spring seeding will be much less than a fall seeding. One bushel of seed should be used for each 5 acres, and in the South it should never be sown with a nurse crop.

ALSIKE CLOVER.

Alsike clover varies greatly with the soil on which it is grown, making its best growth on rather low heavy soils, being quite per-

sistent on dry clay uplands, and of little value on sandy soils having a low content of lime. It is a perennial similar to white clover in its general habit and persistency, but having nearly the size and vigor of red clover, which make it one of the best grazing plants on suitable soils. Its yield of hay is light, but it bears grazing well. Alsike clover is the best of the clovers for mixing with redtop for wet soils and will furnish good grazing long after the grass has stopped growing. It should be sown in August or September at the rate of 10 pounds of seed per acre.



FIG. 4.—Crimson clover being harvested for seed with a reaper.

CRIMSON CLOVER.

Crimson clover is an annual which begins its growth with the fall rains, often giving good grazing from December to April, when it matures its seed and dies. It has succeeded better and seemed more at home on the Atlantic coast than farther west, though it has given good results in many scattering localities as far west as Louisiana. Inoculation is of great importance to its success, and many of its failures have doubtless been due to the absence of the proper bacteria. It is also very desirable that the seed be sown just before or after rain. Many of the failures in the western part of the cotton region are due to the dry weather which usually prevails during September and October. Under favorable conditions crimson clover reseeds itself

even though the ground be plowed and used for some short summer crop like millet.

The hay made from crimson clover is of excellent quality if cut when the plants begin to bloom, but if cut after the seed begins to ripen it is an unsafe feed, as the hairs from the chaff about the seeds often form immense hair balls in the stomach. The crop gives good spring grazing for cattle and hogs, and it is a common practice to sow the seed between the rows of cotton and corn for winter grazing, for its value as a cover crop, and for its fertilizing effects. (Fig. 4.)

LESPEDEZA, OR JAPAN CLOVER.¹

Lespedeza, or Japan clover, is an annual which is now grown in nearly all of the cotton region except on the light sandy soils of southern Florida. It thrives best on a soil with a fair amount of lime and one that is clayey rather than sandy, but it grows on all kinds of soil. On very thin or sandy soils its growth is usually so low and spreading that it can be used only for grazing, while on better soils its habit is more erect, reaching a maximum height of 30 inches and sometimes making a yield of 3 or 4 tons per acre. The hay is fully equal to that of red clover or alfalfa, as the stems are very slender and the principal bulk consists of leaves.

When grown for hay lespedeza usually follows oats. The oats are sown in September or October, and in February or March the ground is harrowed and the lespedeza seed sown at the rate of half a bushel per acre. The lespedeza makes little growth until after the oats are harvested, but it then continues to grow until killed by frost. When wanted for grazing, the seed may be sown at any time from December to March. Many planters secure it in their pastures by cutting some of the hay late in the fall and scattering it over the hilltops, thus seeding in spots, whence it soon spreads over the whole field. Lespedeza makes its growth late in the season, being of little value before May or June, but bears the summer drought well and continues to improve until killed by frost. It is the most widespread and most valuable self-seeding legume in the entire cotton region.

BLACK MEDIC, OR YELLOW TREFOIL.

Black medic takes its name from the fact that the small clusters of seed pods are black when ripe. It is called yellow trefoil on account of the yellow color of its flowers. The plant is usually a winter-growing annual, though it occasionally lives through the summer. Nearly its entire growth is made during the fall and winter months, mostly prostrate branches 1 to 2 feet long, and reaching only a few

¹ McNair, A. D., and Mercier, W. B. Lespedeza, or Japan clover. U. S. Dept. Agr., Farmers' Bul. 441, 19 p., 6 fig. 1911.

inches in height, and so is more valuable for pasture than for hay. It is quite hardy and bears heavy frosts with little injury.

Its most important use is in permanent pastures, as it reseeds the ground freely and so needs to be planted but once. Seed should be sown in August or September, using 8 to 10 pounds per acre, and the ground should be disked or heavily harrowed in order to break the crust and make loose material which will cover the seed when the first rain falls. It is better to inoculate the seed before sowing. This can be done by mixing it with about an equal weight of soil in which alfalfa, melilotus, or bur clover has been grown. It is much like lespedeza in its growth, except that it grows in winter instead of in summer, but its tendency to lodge when the stems become more than a few inches in height makes it difficult to save for hay. It is an excellent crop for growing on Bermuda grass sod, as it is at its best at the time the Bermuda grass affords little feed.

COWPEAS.¹

Cowpeas are grown more widely in the cotton region than any other cultivated leguminous crop and should have a place on every farm. The varieties differ greatly in habit and time of growth. Some produce long trailing vines, while others are usually erect and bushy in growth; some will ripen in two months from planting, while others require four or five months; even the same variety is greatly modified when planted on unlike soils or at different seasons. Cowpeas are inexpensive to grow and produce well on all soils except those which are very wet. They are excellent for hay or grazing and are the best summer catch crop for green manuring and improving soils. Though this crop will make a fair growth on very poor soil it responds quickly to an application of fertilizer, and as a heavy growth of cowpeas is the best possible insurance for a heavy following crop it pays well to use any fertilizer which will produce a thrifty growth of vines.

Cowpeas may be sown broadcast or in drills 3 to 4 feet apart, the first method requiring more seed and less labor, while the drills permit one or two cultivations, require less seed, are more easily mown for hay, and usually give a heavier yield. From 4 to 6 pecks per acre are used in broadcasting and from 2 to 3 pecks for seeding in drills, though even 2 quarts of some varieties are sufficient when carefully dropped by hand. A common and excellent practice is to sow cowpeas between the rows of corn at the last cultivation.

When cowpeas are sown broadcast with a small-growing variety of sorghum, like the Amber, using a bushel of the peas and half a bushel of the sorghum seed per acre, the mixture makes fine hay, and when sown in drills with a coarser sorghum, like the Orange, makes excellent silage.

¹Nielsen, H. T. Cowpeas. U. S. Dept. Agr., Farmers' Bul. 318, 28 p., 8 fig. 1908.

Saving the hay in good condition is usually a difficult matter in unfavorable weather, and for that reason the planting should be done at such a time that the crop will mature during the dry weather usually prevailing during September and October. To make the best hay the vines should be cut as soon as the earliest pods become yellow, though the work may be delayed a few days if rain should threaten. When cut at that stage, the vines cure much more easily and rapidly than when cut earlier, the total yield is at its heaviest, and the hay will be eaten readily and will have a higher nutritive value, though it may not be quite so tender.

A common practice in saving the hay is to start the mower as soon as the dew is off in the morning and run it until noon. As soon as the upper surface of the cut vines is well wilted a tedder is run over the field to turn the vines over and expose them more thoroughly to the sun and air. If the crop is very heavy this may have to be done twice. When a tedder is not available the work can be done with a pitchfork, but this is slower and more expensive. Vines which have been cut in the morning and turned in the afternoon will usually be dry enough to put into small cocks the following afternoon, and if the weather promises to be favorable they should be left in these cocks two or three days before they are hauled to the barn. If it rains before the vines are put in cocks, they should not be touched until the surface is well dried and then they should be turned as though freshly cut. If the hay is handled promptly and properly a light rain does very little harm, even after curing has begun, and a heavy rain may fall on freshly cut vines and do little or no damage. The vines should be handled as little as possible; otherwise many of the leaves will drop and be lost. When the weather is fair and settled the freshly cut vines are sometimes rolled into bundles as large as can be handled easily with a pitchfork and allowed to lie in the field until thoroughly dry. This method saves labor and prevents any loss of leaves, but the tangled bundles are hard to dry if they should be wet with rain. When peas are grown with corn and are wanted for hay it is best to cut the vines and stalks together and make into windrows the same day. The cornstalks prevent the vines from packing closely, so that they dry more quickly. Such hay can often be put in the barn safely two days after it is cut. Cowpea hay is often cured by stacking the wilted vines around poles 4 to 6 feet high with two or three crosspieces nailed on each. A still better device consists of four poles 6 feet long joined at the top and held 4 feet apart at the bottom by means of crosspieces on which the vines are piled so as to cover the pyramid. The object of both devices is to permit the air to circulate more freely among the vines and so dry them with very little handling and loss of leaves.

When fed on well-cured cowpea hay containing a fair number of matured pods, horses and mules will keep in good condition through the winter with no grain feed.

The selection of the variety for planting should be determined by the use to be made of the crop. If a heavy yield of hay is the principal object, a vigorous upright variety, like the Whippoorwill or the Groit, is best. If the crop is to be pastured or left to decay on the ground through the winter, any of the trailing sorts, such as the Black, Red Ripper, and Unknown, are good. The Blacks are especially esteemed for this purpose, as the seeds do not decay easily. Where land is infested with wilt or with root-knot, only varieties resistant to these diseases, such as the Iron and the Brabham, should be used.

SOY BEANS.¹

Soy beans have been cultivated in this country more than 100 years, but it is only within the last few years that they have become an important crop. They are grown both for forage and for seed. The number of varieties is very large, and they differ greatly in habit, in maturity, in color of flowers, and in color and size of seeds. The varieties may be strictly erect, with few or no branches, widely branched and bushy, or viny; some ripen within 85 days of planting, while others require six or more months to mature; in certain varieties the flowers are white, while in others they are purple; the seeds are cream, yellow, green, brown, or black.

Soy beans succeed on the same kinds of soil as does corn, and they are less injured either by drought or excessive moisture. They are not as well suited to very poor soils as cowpeas are, though they will do well on a soil too poor for corn. When planted early in the season the soil should be prepared as for corn, making the surface as smooth and fine as possible, but when planted after oats or early potatoes a thorough disking is all that is needed. Fertilizers are not usually profitable, though the yield is often increased by an application of acid phosphate.

Soy beans may be planted fully as early as corn, or the planting may be delayed until about three months before frost is expected. In most of the cotton region, plantings made from April to June are the most successful. Under ordinary soil conditions the planting should be very shallow, not more than 1 inch, but may be 2 or 3 inches where the soil is very light. If soy beans have not been grown on the land previously, the seed should be inoculated. The quantity of seed needed will vary with the size of the seeds and the size of the plants. For the smaller growing sorts, like the Ito San, which should be planted in drilled rows 2 to 3 feet wide with the plants 2 to 4 inches

¹ Morse, W. J. Harvesting soy-bean seed. U. S. Dept. Agr., Farmers' Bul. 886, 8 p., 7 fig. 1917.

—— The soy bean: Its culture and uses. U. S. Dept. Agr., Farmers' Bul. 973, 32 p., 15 fig. 1918.

apart, from half to three-quarters of a bushel of seed should be used to the acre, but with the coarser growing sorts, like the Biloxi, which may be planted 18 inches apart in 5-foot rows, 2 quarts will plant an acre. It is nearly always better to plant in rows, so that at least one cultivation can be given, as the crop seldom makes a satisfactory growth when broadcasted. The choice of a variety for planting will depend principally on the use which is to be made of the crop. Soy beans are often planted with corn, either in alternate hills or in alternate rows. They are sometimes planted with corn for silage, and in that case a variety which will ripen at about the same time as corn should be used, but if not wanted for silage it is better to plant a variety which will ripen some weeks later, as it will be less injured in gathering the corn. The yield of seed may vary from 15 to 50 bushels per acre, 25 bushels being probably a fair average.

The feeding value of the beans is very high, as they contain more protein than cotton seed, the average protein content of 20 varieties being 39.15 per cent. The oil content is also very high, so that pork made from hogs fattened on soy beans, as also with peanuts, is likely to be soft; but when soy beans are grazed by hogs in the fall and the hogs are then fed on corn for a month or so the pork will be hard and in prime condition. The oil can be extracted from the seed by essentially the same methods used to extract cottonseed oil, and it commands a high price for industrial purposes. The cake which is left after the oil is extracted is used in the same way as cottonseed meal and is also a valuable feed.

Soy beans should be harvested for hay as soon as the pods are well filled. If wanted for seed the cutting should be delayed until the leaves fall, but not longer, as most varieties shatter seed after ripening. Thrashing can be done with an ordinary thrashing machine by taking out a part of the concaves and running very slowly. Several machines especially designed for the purpose are now on the market. When there are only a few beans to thrash a flail will prove very satisfactory. Special harvesters for gathering the seed from the plants in the field are now quite generally used in sections devoted to seed growing. After thrashing, the seed should be thoroughly dried and aired before being stored away, and seed more than a year old should never be planted without first being tested for germination. The material left after thrashing makes a fair quality of hay.

VELVET BEANS.¹

The velvet bean is the most vigorous growing annual legume cultivated in the United States, and the area of its profitable cultivation is very nearly the same as that of the cultivation of cotton east of Texas. Velvet beans were grown in Florida at least 40 years ago,

¹ Tracy, S. M., and Coe, H. S. Velvet beans. U. S. Dept. Agr., Farmers' Bul. 962, 39 p., 14 fig. 1918.

but at that time only one variety, the "Florida," was known, and as it seldom matured seed in any other part of the country and its agricultural value had not been discovered, it was used mainly as an ornamental climber. About 1907, several other sorts, most of them from southern Asia, were introduced by the Department of Agriculture. Other varieties were produced by crossing and hybridizing, and there are now many varieties, differing from each other greatly in length of season required for ripening, vigor of growth, form of pod, color of flowers and seeds, and in many other ways. Some varieties ripen so late that they can be grown only in southern Florida, while others ripen well as far north as Tennessee; some are so dwarf that they make only straggling bushes, while others make vines 50 feet or more in length. They produce two distinct types of pods, one covered with a dense, black, velvety pubescence, as in the Florida, Georgia, and Osceola varieties, and in the other type the pubescence consists mostly of short white or grayish hairs, as in the Lyon, Chinese, and Yokohama velvet beans. The pods of nearly all the gray-podded sorts have a tendency to split open and scatter the seeds when left long in the field after ripening, but the black velvety pods seldom shatter. In most varieties the pods have more or less short bristles which cause a slight irritation of the skin when handled. The pods of some varieties are only 2 or 3 inches long, and in others they are 4 to 6 inches. The seeds may be of almost any color, from white to mottled brown or black. All the varieties need practically the same treatment, and the choice between them will depend largely on the locality where they are to be grown. It is an almost invariable rule that the earlier a variety ripens the smaller will be the growth of vine and yield of seed, so the strongest growing variety suitable to the locality should be selected. In a locality where the late-ripening sorts will mature if planted early, one of that sort should be used for plantings made early in the season. Velvet beans are not eaten readily until well after maturity, and as they are wanted mostly for winter grazing and no fall crop can be planted on the ground where they are grown, it is best to select a variety which will not mature until about the time when a killing frost is expected, so that the ground may be occupied by a growing crop during the entire growing season.

All the varieties of velvet beans except the bush variety require a support of some kind in order to make the greatest production of seed. Corn serves the purpose well and so is commonly used in the place of poles, which would be better but are much more expensive and troublesome. Planting with corn is the best and most profitable way in which they can be grown. The beans are often planted in the same rows and in alternate hills with the corn. This is an excellent method when one of the smaller growing sorts is used or where the crop of both corn and beans is to be used for silage. By this

method the growth of the corn is affected very little and its gathering scarcely interfered with. When a larger and stronger growth of vine is wanted it is better to plant the beans in alternate rows with the corn, putting the rows only about 3 feet apart, or, still better, planting two rows of corn to one of beans. Planted in the last way the beans interfere little with gathering the corn, and even when large-



FIG. 5.—Velvet beans grown in mixture with corn.

growing sorts are planted in the rows with the corn they make little trouble if the corn is not gathered until after frost has caused the leaves of the beans to drop. (Fig. 5.)

The rate of seeding will vary with the purpose for which the crop is grown. When velvet beans are planted with corn and it is desired to secure as much corn as possible, they should not be planted so

closely as to interfere with its growth, and from 2 to 3 quarts per acre will be sufficient, but if a heavy crop of beans is wanted and the corn is not of first importance, twice as much seed should be used. These quantities are for the small-seeded sorts, such as the Florida and Alabama, while for the larger seeded sorts, like the Chinese and Osceola, the quantities should be nearly doubled. When planted to make the heaviest possible quantity of vines, either for green manuring or as a smothering crop, from half a bushel to a bushel of seed should be used.

The growing of a smothering crop of velvet beans is the easiest and most effective method known for the eradication of Bermuda grass and other weeds, and at the same time it gives a large amount of winter grazing and puts the land in the best possible condition for succeeding crops. When used for this purpose the vines should be given no support.

The vigorous growth of velvet beans together with their large yield of seed, which may be gathered or allowed to remain in the field without much injury during the autumn and winter, permits this crop to be utilized in a number of different ways.

Velvet beans are seldom used for hay, as the vines become so long and tangled that it is very difficult to handle them. But if used for this purpose it is necessary to cut the vines before many of the pods mature, in order to save the leaves, which are lost rapidly from this time until maturity. The hay is rough and coarse at best and is not relished by horses and mules. Yields of 2 to 3 tons per acre may be obtained.

Velvet beans have been employed to some extent in the making of silage, and for this purpose early-maturing varieties like the Alabama are commonly used. With such a variety most of the vine growth is wrapped about the cornstalks, and little trouble is experienced in cutting the corn with corn knives and in running it through the silage cutter. Silage made from this mixture turns black after it has been in the silo for a short time, on account of the juices in the velvet-bean plants, but this apparently does not impair its keeping qualities or feeding value. Stock eat silage made from this mixture as readily as that made from corn alone. Dairymen who have used this mixture speak highly of it and now use it in preference to silage made from corn or sorghum alone. When the silage is cut so early in the season that the bean vines have not become weakened by age they will often make a thrifty second growth and mature a fair crop of seed.

The most important use of the velvet bean is as a grazing crop for cattle and hogs in the autumn and winter. It is not grazed well by horses and mules or by any stock until after it has been well matured or frosted. As the leaves, vines, and pods decay slowly when sub-

jected to weather conditions, velvet beans will furnish feed until early spring. It is usually better to let the crop stand until it is killed by frost, as the leaves will be off the plants at that time and the corn may be gathered with less difficulty. The beans needed for seed should be gathered before live stock are turned into the field. The amount of grazing which will be afforded will, of course, depend upon the growth of the crop and the quantity of corn which is not gathered, but it is the custom with many cattlemen to allow one-third to one-half an acre per month for each steer or cow. The usual period for pasturing velvet beans is about three months, but this may be shortened or lengthened, as deemed advisable. When the acreage of beans is large and there are not sufficient cattle to stock the pasture at this rate, the grazing is often continued for four or five months, but there is necessarily some loss of feed through decay. Hogs should be permitted to follow the cattle, as they will consume practically all the beans which have been broken from the plants and wasted by the cattle. A common practice is to allow one or two hogs in addition to the cattle for each acre of beans.

On the heavier soils there is some danger of packing the land if grazing is continued in rainy weather. On this account pasturing on such soils should be done with more care than on sandy lands.

A good stand of velvet beans should produce about 200 pounds of beef and 100 pounds of pork per acre. When hogs alone are grazed the yield of pork should be 300 to 500 pounds per acre. Velvet beans are not a perfectly safe feed for pregnant sows, as apparently they sometimes cause abortion, nor for very young pigs, on which they sometimes cause sores, but they are perfectly safe for all other animals. Many breeders claim that the beans are never injurious when the sows have constant access to water. Cattle eat the entire plant, including the pods, but hogs reject the pods, so it is better to have cattle precede the hogs in grazing. As the beans contain relatively little oil they do not make the pork soft, as is the case when hogs are fattened on cowpeas and peanuts.

The pods and seeds are sometimes gathered and ground into meal for feeding cattle and hogs, but as hogs do not like the pods the meal must be ground very fine or they will not eat it. Cattle eat the meal with relish, but it is doubtful whether the grinding pays for its cost, as tests made at several of the southern experiment stations show that there is little difference in feeding value between the whole beans and pods and the meal. When the beans and pods are fed to cattle they are eaten better if soaked in water for 12 hours before feeding, as they can then be masticated much more readily.

VETCHES.

Of the many kinds of vetch that have been tested in the cotton region only three, the hairy, the common, and the Augusta, have come

into general use there. All are winter-growing annuals and reseed the ground so freely that with proper management they may perpetuate themselves indefinitely. The hairy vetch is the strongest growing of the three and produces the heaviest yield. All prefer a soil containing a fair amount of lime.

Hairy vetch does well in all the black prairie and alluvial regions, where it is usually grown with winter oats or rye. Seed is sown in September or October, using about a bushel of oats or half a bushel of rye and from a peck to half bushel of the vetch. In favorable seasons the crop will give good grazing from December to March, after which the stock should be taken off to give the vetch a chance to mature seed. When the vetch seed begins to ripen, about May, the mixture will yield about a ton per acre of hay which is of the very finest

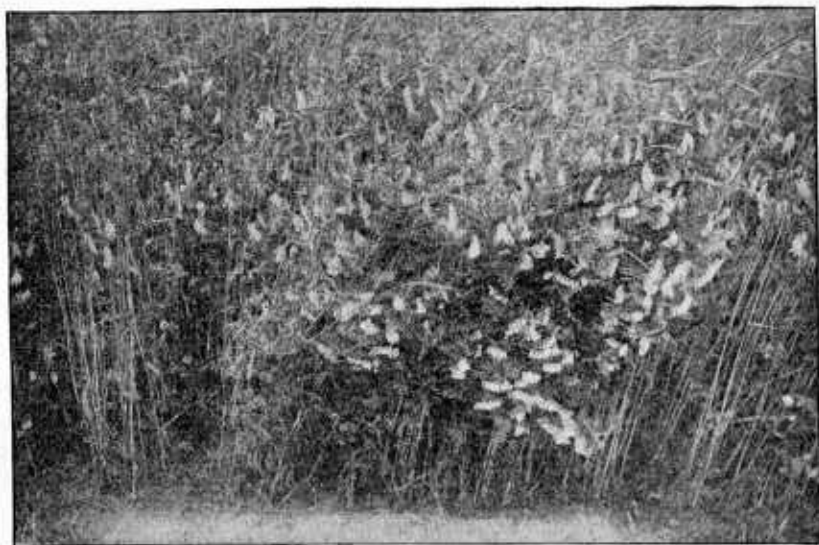


FIG. 6.—Hairy vetch growing at Arlington Farm, Va.

quality, and enough of the vetch seed will be scattered on the ground to reseed the field for the following season. During the summer the ground may be used for corn, millet, or any other short-season crop and if plowed and reseeded with oats in September will make a better yield than in the previous season. On lands set in Johnson grass some growers plow after the last cutting in September and seed with vetch and oats. This gives good winter grazing, a crop of mixed vetch and oat hay in April or May, and two heavy cuttings of Johnson grass during the summer, after which the ground is again plowed and seeded with oats only, as the vetch does not usually need reseeding. (Fig. 6.)

Augusta vetch needs about the same treatment as hairy vetch. However, it is much more persistent in meadows not given cultiva-

tion and is one of the best kinds for pasture lands. It is one of the earliest maturing of the vetches. On bottom lands producing Johnson grass hay in the summer, Augusta vetch in combination with other volunteer winter annuals, such as hop clover and grasses, occupies the land in winter to advantage and produces winter pasturage or an early crop of hay. The seed of this vetch is small, and about 30 pounds per acre is all that is required in sowing.

Common vetch is used more or less throughout the South, but has not given consistently good results. The strains of common vetch differ in winter hardiness and other characteristics, and these differences may account for the varied success. In general, common vetch is handled the same as hairy vetch. Its seeding rate, however, should be about 60 pounds to the acre.

All vetches grow much more vigorously and seed much more freely when grown with oats or some other crop which at least partly supports the vines, as they make a poor growth and do not seed well when lying flat on the ground.

Some of the native vetches, especially the Louisiana, occur in many meadows and are highly valuable, but their yield is so much less that their cultivation is much less profitable than the three mentioned.

When planting vetch for the first time it is necessary to inoculate the land by using soil from an old vetch field or by the use of cultures if soil is not procurable.

FLORIDA BEGGARWEED.

Beggarweed is an important forage plant from central Florida northward to southern Georgia and Alabama, and occasionally farther north. It is an annual which makes its growth late in the season at the time that crab-grass is growing most rapidly, the two usually being found together. The plant is erect and grows to a height of 5 to 7 feet on good soils. When cut at the right time and properly cured it makes a superior hay, but it must be handled carefully. If allowed to become too old before it is cut, many of the lower leaves are lost and the stems become woody. After cutting it should be wind-rowed as soon as wilted, to prevent the leaves from dropping. To make good hay it should be cut when not more than 3 or 4 feet high, usually in July, and a second cutting can be made a few weeks later. Although not sufficiently bulky for use in filling a silo, a little of it mixed with other material adds greatly to the value of the silage, as it gives a marked June flavor to butter even when used in midwinter. Its greatest value, however, is as a grazing plant in late summer and early winter, it being even more fattening than alfalfa or cowpeas.

Florida beggarweed usually makes a scattering and uneven volunteer growth on land which has not been plowed during the year, though when occasional strips are left standing at the second cutting

and the field is then harrowed crosswise to scatter the seeds a good crop is grown the second season after plowing. The better practice is to reseed the ground after oats, melons, or some other early crop has been removed, using 20 to 30 pounds of the rough seed per acre.

In the region where it is grown most commonly beggarweed is seldom seen as a volunteer crop on newly cleared lands, but is more or less abundant, growing with crab-grass and Mexican clover in nearly all old fields, especially in corn and cotton, where it springs up after the crops are laid by and furnishes a large amount of good grazing after the crops have been gathered. Some cotton growers object to it in their fields, as the immature seeds are somewhat rough, and



FIG. 7.—Kudzu, showing its heavy vegetative growth.

when the stalks are switched about by the wind the seed cotton is often pulled from the bolls.

Beggarweed is easily killed by a single cultivation in late summer and soon disappears from fields which are not plowed. Although it is a crop of secondary importance and seldom used alone, it is a welcome addition to any hay crop, and when so abundant as to afford good grazing it will fatten horses, mules, and cattle more rapidly than most other plants.

KUDZU.

Kudzu¹ is a large-leaved, woody, leguminous vine, native to Japan, which grows with remarkable rapidity. It succeeds better on clay soils or soils with a clay subsoil than on sandy soils. Where the summers are warm and moist it grows with great luxuriance.

¹*Pueraria thunbergiana*.

(Fig. 7.) Kudzu is a most excellent vine for arbors and porches, for which purpose it is grown in most of the southern cities, climbing to a height of 60 feet or more. It succeeds well, however, as far north as Nova Scotia. The leaves resemble in a general way those of the common bean, but they are larger and angular lobed, besides being tougher in texture; the stems and leafstalks are somewhat hairy. As far north as Washington the vine will bloom, but only occasionally and then late in the fall. The blossoms are dull purple-red and hang in clusters. The pods are thin, very hairy, and rarely mature in the latitude of Washington. Kudzu is usually propagated by layers or roots. The vines are very long, and take root at any joint which rests on the ground. It can be grown from seeds, but the young seedlings are very weak and tender, so roots are preferred. The roots are usually planted about 8 by 8 feet in cornfields, and if the corn is kept well cultivated no attention need be given the kudzu during its first season. Planting should be done very early, January or February being the best months, as it begins its new growth very early in the spring, after which the transplanting is seldom satisfactory. During the second season no other crop can be grown on the land, and the kudzu should have the ground well covered with vines and roots. Under favorable circumstances a moderate cutting of hay may be made, or it may be grazed lightly just before frost is expected. It is not until the third season that a full crop can be secured, but after that heavy, abundant crops may be expected. Though the vines are long and tough they are not especially difficult to handle. In mowing, a scythe blade or something similar should be fastened vertically to the outer end of the cutter bar so that the swaths will be separated. Raking is usually done with a fork, pulling the vines into small piles which can be handled easily in loading a wagon. When made into hay the vines retain the leaves much better than most other legumes, and the hay is injured very little by rain which may fall upon it when nearly or quite dry. The hay is usually rather dark in color, but is eaten greedily by all kinds of stock, being especially valuable for colts and calves. When grown on a rich soil, at least three cuttings of 2 to 3 tons each may be expected, and total yields of 10 tons are often claimed.

Kudzu is used more largely for grazing than for hay, most graziers preferring to have two fields which are grazed alternately, although the Georgia Experiment Station has made a series of tests which indicate that continuous moderate grazing gives the best results. It is not desirable for grazing dairy cows, as it often affects the milk unpleasantly. Some graziers prefer to let it grow through the summer and make a dense mass of vines and foliage, 2 to 4 feet deep, and then graze it during the dry weather of September and October when other pasturage is getting dry and scarce.

The principal objection to the plant is that it requires a long time to make full growth and that, being a perennial, it can not be used in a rotation. There are many places on rough and waste land, however, on which it can be grown to advantage, and it is easily killed by plowing in May or June.

PEANUTS.¹

Peanuts are grown throughout the cotton region, as the crop requires about the same climatic conditions as cotton. A large proportion of the crop is harvested for the seeds, with the incidental production of much excellent hay, but to a large and increasing extent peanut crops are utilized by pasturing with hogs. (Fig. 8.)

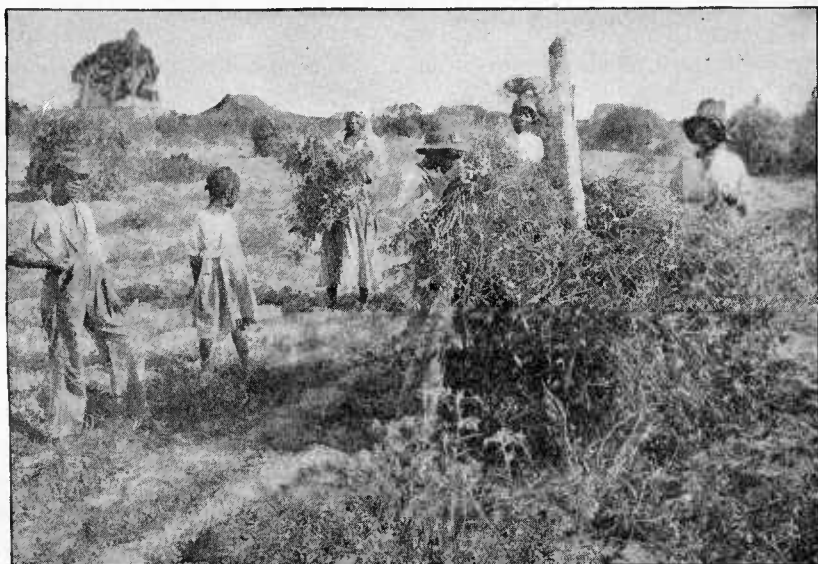


FIG. 8.—Piling peanuts for hay.

There are many varieties of peanuts, and all furnish excellent pasturage, but probably the best for forage purposes are the Spanish and the Valencia.

Hogs gain rapidly on peanuts, but the pork produced is soft and oily and so brings a lower price on the market.

MISCELLANEOUS FORAGE CROPS.

While grasses and legumes furnish by far the most important forages, other plants, especially those with tuberous roots or very succulent foliage, are often useful and desirable. Among those grown in the Southern States are Mexican clover, Jerusalem artichokes, ehufas, sweet potatoes, cassava, and rape.

¹ Beattie, W. R. The peanut. U. S. Dept. Agr., Farmers' Bu. 431, 39 p., 20 fig. 1911.

MEXICAN CLOVER.

Mexican clover, sometimes called "pusley" or "purslane," though entirely different from the plant known by those names in the North, is not a true clover, but belongs to the same family as the madder, bedstraw, and a number of other common plants. It is an annual of much the same habit of growth and size as common red clover, but the leaves are opposite and simple instead of alternate with three leaflets. It grows most abundantly in cultivated fields from which early crops have been removed and often makes a heavy growth in corn and cotton after those crops have been laid by. It is seldom planted, as, like crab-grass and beggarweed, it makes a volunteer growth late in the season. It is doubtful whether the yield would be increased materially if it were sown early and the ground given up to it through the whole summer. It is common in old fields near the coast from Florida westward to Mississippi. It makes a fair growth on soils too poor for most other crops and may be used both for hay and for grazing. Although the hay is not of the best quality it is eaten readily by most farm animals, and as it is usually more or less mixed with crab-grass and beggarweed it adds largely to the bulk and value of an inexpensive crop. When used for grazing it is more valuable for hogs than for other stock, though eaten well by mules and cattle. It can be grazed from about June until after heavy frosts and will then reseed the ground abundantly.

The seeds are very small and difficult to save, though they are sometimes beaten out with flails or gathered from the bottom of a mow in which the hay has been stored. From 4 to 5 pounds per acre are sufficient for seeding, but the common method of distributing the plant is by mowing after some of the seed is matured and scattering the hay over the field on which the crop is wanted the following season. A planter in northern Florida who has grown beggarweed 15 years reports that he has kept 4 horses and 20 hogs in good condition for 8 months on a field of 7 acres. The field had been in oats the previous season and the growth was somewhat mixed with crab-grass and beggarweed but was mostly Mexican clover. A southern Mississippi grower states that these plants double the yield of his volunteer hay crop and that the mixture is worth fully as much as any hay he can buy.

Although it is not a nitrogen-gathering plant like the true clovers, the growth of Mexican clover is usually volunteer and so costs nothing. It protects the surface of the ground from the scorching sun in summer and washing rains in winter and adds humus to the soil. The plant should be regarded as an inexpensive substitute for something better rather than one to be sown and cultivated carefully.

CHUFAS.

Chufas are a profitable crop on sandy soils for winter grazing by hogs and poultry. They grow best on soils which are light and sandy and yield well with moderate cultivation. They involve no expense for gathering and storing except for the small number of tubers which may be wanted for the following season. Chufas should be planted in early spring about a foot apart in rows 3 feet apart or as close as they can be cultivated conveniently, using about half a bushel of tubers per acre. No special care is required except to keep the ground free from weeds. They can be used from September to January. Many growers claim that the tubers are more fattening than peanuts. The quality of the pork is no better than that produced by feeding peanuts.

RAPE.

Rape is an annual, very succulent plant belonging to the same family as the collard and having much the same habit of growth. It grows well only during cool weather, bearing severe frosts without injury but languishing when hot weather comes. It is especially desirable for cattle, sheep, and hogs and is usually pastured. It should be sown as early in the fall as the nights become cool, or about September, and will then be ready for grazing in six to eight weeks. Later sowings will furnish grazing until late winter, and very early spring sowing will give late spring feed. It is seldom profitable to sow rape later than April 1. It should be sown on a rich soil such as would be used for growing cabbages, planting in drills, so that it can be cultivated at least once, and 3 to 5 pounds of seed should be used per acre. The variety known as Dwarf Essex is the best for general use. Cattle and sheep should be grazed carefully at first, as overeating is liable to cause bloating, and dairy cows should be grazed on it only soon after milking, as when grazed just before milking the rape is likely to give the milk an unpleasant flavor. Hogs may be grazed on it indefinitely without danger of injury.

SWEET POTATOES.

Sweet potatoes are very easily grown and make heavy yields in all the pine-woods regions and in other sections having sandy soils. In the southern part of the cotton region they can be planted at any time from March until July, and so can be had ready for use from August until midwinter, though those planted early in the season do not yield as heavily or keep as well as those which are planted later. They are used quite extensively for grazing hogs, and as they make from 4 to 6 tons of tubers per acre and cost nothing for gathering they are an inexpensive feed for fall fattening. The vines make unusually good feed for dairy cows and should be used for that pur-

pose whenever possible. They are so succulent that they are difficult to make into hay, but will keep in good condition for feeding for a long time after they are cut.

JERUSALEM ARTICHOKEs.

Artichokes make a valuable grazing crop for hogs in the northern and central parts of the cotton region, but yield less heavily and are less desirable farther south. They require the same soil, methods of planting, and cultivation as Irish potatoes, but yield much more heavily and are worth fully as much for feed. They are strictly a winter feed, not being well matured until December. From that time until March they furnish perhaps the least expensive roots grown for hog feed. No special cultivation is needed except to keep down weeds. When the crop is matured, enough of the tubers for planting the next season should be plowed out and buried like potatoes, after which the hogs may be turned into the field. Though the hogs will leave a few of the tubers in the ground, it is not well to depend on them for a crop the following year, even when they are to be grown on the same ground. Such scattered tubers may make a fair stand, but they will be so irregular that the ground can not be cultivated and the yield will be small. It pays much better to plow the ground and to plant in regular rows.

Even with the most careful digging a few tubers will be missed, and these will make a volunteer growth the following season. Many farmers object to them on that account, but if the volunteer plants are plowed out or hoed off in midsummer after the old tubers have become exhausted and before the new ones have formed there will be no further growth. While artichokes alone are a poor ration either for growing or fattening hogs, 3 bushels of them fed with 1 bushel of corn are fully equal to 2 bushels of corn, and the fresh feed which they give keeps the animals in much better health than when fed on corn alone.

CASSAVA.

Cassava was formerly grown quite extensively from Florida and southern Georgia westward to southern Texas, but other root crops, especially sweet potatoes, can be produced at less cost in most of the region, so now the cultivation of cassava is confined almost wholly to central and southern Florida.

Cassava does best on light sandy soils, on which it yields 5 to 7 tons of roots per acre. The roots are similar in appearance to those of sweet potatoes, but are much longer and make an excellent feed for cattle and hogs. Cassava is propagated by sections of the old stems, which are cut into pieces 4 to 6 inches long and planted about 4 feet apart each way, the cultivation being the same as that given to corn. Cassava should be planted about the same time as cotton,

the crop maturing from October to November. The roots will remain in the ground all winter in good condition, but as they decay in a few days after exposure to the air they should not be dug until wanted. The stems which are used for planting are killed by moderate frosts and are difficult to preserve in good condition through the winter except in the extreme South. The best method of preserving them where heavy frosts occur is to cut them when well matured and bury them in a dry place where they will not become frozen.

HAY CROPS.

A good hay plant should make a large growth, be leafy, have fine and tender stems, be palatable, and grow so erect that it can be cut readily with a machine. If the meadow is to be permanent the plants should be perennials, while if temporary, annual plants are usually more profitable. If the hay is to be used exclusively for dairy cows, fattening stock, or for young and growing animals, the plant should be a legume, but the true grasses make a hay which is more satisfactory for livery horses and other animals doing hard work. If the hay is to be sold, of course the choice of grass will depend on the demands of the market to be supplied. It is often the case that hay can be made which is so palatable and nutritious as to be highly valuable on the farm, but so coarse and unattractive in appearance as to be almost unsalable on the market. Such hay should be valued by its feeding rather than by its market value. Cowpea hay mixed with cornstalks, cockleburrs, and ragweed may have little sale value, but it will keep mules in fine condition through the winter without the addition of any grain. For ordinary farm use hay made from a mixture of both legumes and grasses is more desirable for general feeding than hay made from either alone.

PREPARATION FOR PERMANENT MEADOWS.

In the cotton region, where a crop of good hay can be grown in almost any three summer months when the fields are not in use for other purposes, annual and catch crops furnish a large part of the hay, and permanent meadows are less important and less common than farther north, though they are profitable in many localities. The most productive meadows are usually those which contain at least two kinds of plants, one of them a legume which makes its best growth early in the season and the other a grass which gives its heaviest yield in the summer and fall. After a field has been used for such crops during two or three seasons the yield of hay is so decreased that it is usually better economy to plow and harrow or disk the field in the fall, after the last cutting for hay, which will leave it in the best possible condition for cotton or grain the following spring.

A permanent meadow requires a rich soil, thorough preparation of the ground, and constant care. Before it is planted the surface should be made smooth and even, so that there will be no ridges or ditches to interfere with the use of the mowing machine or the rake, and all low spots should be filled in or drained so that water can not stand to kill the grass. None of this work can be done after planting without serious injury to the stand. If the soil is not rich it should be made so by the use of stable manure or by the plowing under of a crop of cowpeas. Such fertilizing is usually much more effective than the use of commercial fertilizers, which furnish no humus, one of the greatest needs for the production of heavy yields of grass. If the land is too poor and thin to make a good yield of cowpeas it is too poor for a meadow, and if it can be made to produce a good yield of pea vines the success of the following hay crop is practically assured.

The profitable life of a meadow depends largely on the kinds of plants used, the character of the soil, and its treatment, the treatment being, perhaps, the most important factor. Where the growing season is nearly continuous the roots of any perennial hay plant soon become so numerous and densely matted that an occasional plowing and harrowing of a crop like Bermuda grass or Johnson grass is highly beneficial, and the disking of a crop like alfalfa will stimulate a more vigorous growth. No meadow can continue to make heavy yields without the use of fertilizers, which should be highly nitrogenous for the true grasses and rich in phosphoric acid and lime for the legumes. A winter top-dressing with stable manure is the best fertilizer for any meadow, but is not often available in the cotton region. Such manure should be applied after the last cutting in the fall and disked or leveled with a heavy harrow early in the spring. It makes little difference whether the disking precedes or follows the application of commercial fertilizers.

PLANTS FOR PERMANENT MEADOWS.

The best grasses and legumes for permanent meadows differ widely in different parts of the cotton region. In the northern section timothy does well in some localities, but it can not be depended upon farther south than Tennessee and the Carolinas. In the greater part of the cotton belt Bermuda grass and, in limited areas, Johnson grass are the more important plants for permanent meadows. The seeding with legumes (alfalfa, clover, and the like) and with the perennial grasses should be done early in the fall, if possible, so that the young plants may have time to become well established before cold weather and be ready to begin a vigorous growth with the first warm days of spring. No nurse crop should be used, as the early growth of the hay crop will need all the space before the nurse crop is ready for har-

vesting, nor should any permanent meadow be pastured during the first winter. Alfalfa and red clover make their best growth on land which is well suited to Johnson grass and usually more or less thickly set with it, and the mixture makes a meadow which is very productive of hay of fine quality; in fact, most feeders prefer this mixed hay.

If Johnson grass is already growing on the land where the meadow is to be established no further attention need be given it, the clover or alfalfa being seeded in the fall. Such meadows give two to four cuttings annually, the earlier cuttings being largely of alfalfa or clover, while the later cuttings will contain a larger proportion of Johnson grass. In the black-prairie region and on the heavy black lands of Texas, Johnson grass alone is used largely in permanent meadows, usually giving three annual cuttings. It is important that this grass should be cut as soon as it begins to head, both because it makes a finer and better hay at that time and because it then has no seed sufficiently mature to scatter the grass into fields in which the manure may be used. All Johnson grass meadows need an annual plowing to break up the hard surface and to prevent the roots from becoming so matted that growth is weakened. Many growers take advantage of this fact to grow other crops on the same ground. The grass is plowed in September or October after the last cutting and is then seeded with winter oats and vetch, usually for hay. After this is harvested two or three cuttings of the Johnson grass are made before the land is again plowed and seeded the following September.

For rich river and creek bottom lands Bermuda grass is one of the best hay grasses, as on such soils it makes a heavy yield, 4 to 6 tons per acre in three cuttings. As it starts rather slowly, it is better to plant some other crop on the ground at the same time the Bermuda grass is planted. If the ground is seeded with vetch, either the smooth or the hairy variety, the yield of the first cutting the following spring will be much increased and the quality of the hay greatly improved. When planted late in summer a quick growth can be obtained by sowing Italian rye-grass at the rate of 20 pounds per acre and covering it by light harrowing. The rye-grass will cover the ground in a few weeks, make excellent grazing or a moderate yield of hay the following spring, and then gradually disappear as the Bermuda grass occupies the ground. This use of rye-grass is specially desirable in the making of lawns and in securing an immediate growth of grass about the house. Bermuda grass forms such a dense mat over the surface and yields so heavily that the meadows need an occasional fertilizing and breaking up to keep them in the best condition. For such fertilizing well-rotted stable manure is the best thing which can be used. It should be spread evenly in the fall and then the field gone over early in the spring with a disk harrow

set at such an angle that it will cut the matted sod but will not tear it up enough to leave the surface rough. If stable manure is not available cottonseed meal should be used, applying it immediately after the disking. Dallis grass is a valuable constituent of permanent meadows in certain localities, especially in the northern part of the cotton region, but on account of the high price of the seed it is seldom sown. Along the Gulf coast, particularly in Florida and southern Texas, Rhodes grass is one of the most productive grasses which have been grown; in sections of Florida where the soil is damp and mucklike, Para and Carib grasses are more productive than any others, while on the marshy lands in southern Louisiana the paille finne grass gives heavy yields.

TEMPORARY MEADOWS.

Temporary meadows of short-season annuals grown for hay are of much greater importance in the cotton region where crops may be grown throughout the entire year than they are in sections where the growing season lasts only six to eight months and the growing of such crops would interfere with the other regular crops on the farm. Both summer and winter crops can be used in this way. Not only can they be grown without interference with other crops, but they can also be made highly beneficial to the land by protecting it from washing rains and the scorching sun and, if legumes are used, by adding nitrogen to the soil.

Among the summer crops which can be grown for hay, cowpeas, lespedeza, beggarweed, Mexican clover, crab-grass, the millets, Natal grass, and the sorghums are the more important. Of these, all except sorghum may be grown during the last three months of warm weather and on land which has been used for some other crop earlier in the season. Crab-grass, beggarweed, Natal grass, and Mexican clover are usually volunteer crops, and though their yield is not often heavy, commonly not more than about 1 ton per acre, they are made with no expense except for the harvesting and so are very profitable. Cowpeas make a hay that is worth fully as much as red-clover hay, and it is generally believed that the expense of growing the crop is fully met by the effect on succeeding crops. The fertilizing value of cowpeas is so well recognized that many planters furnish the seed and the use of land free to their tenants for the increase which it gives to the following crop. A great deal of cowpea hay is made by planting the peas in the cornfields at the time of the last cultivation and then mowing both the stalks and vines after the corn has been gathered. Such hay looks rough and coarse, but is rich and nutritious.

Lespedeza is an important hay crop in many parts of Louisiana, Mississippi, and Alabama, and there is no apparent reason why it

should not be equally profitable in other parts of the Gulf States having heavy lime soils. When grown for hay it is usually sown on oat land early in the spring and will then make a yield of 2 to 3 tons per acre after the oat crop has been harvested.

When it is desirable to secure a crop of hay in the shortest possible time one of the millets should be used, as they are ready to cut in 40 to 50 days after seeding.

Winter-growing annuals are used mostly for grazing, but they often make profitable hay crops. Among the best of them for hay are the vetches, crimson clover, oats, and wheat, all of which can be sown after a corn crop has been harvested and can be cut for hay in time for planting corn the following spring. Cotton occupies the ground so late in the fall and must be planted so early in the spring that hay can not be grown profitably on the same ground, though good grazing is often secured. The best hay which can be grown during the winter is a mixture of oats or wheat and hairy vetch, and when on a suitable soil the yield is from 1½ to 2 tons of dry hay per acre. While each of these three crops is often grown alone for hay, the yield is much greater and the hay much better in quality when vetch is grown with the grain. While it is easily possible to secure good yields of hay from a winter crop, the practice of growing such a crop is not likely to become general, since it matures at a season when it cures slowly and when the farmer is usually crowded with other work.

MAKING HAY.

The best time for cutting hay differs almost as much as the methods of curing. Most grasses should be cut as soon as they are well headed; the millets and Johnson grass should be cut as soon as the heads begin to show from the boot, but the winter grains should stand until the seed is in the milk stage. Legumes like cowpeas and soy beans, in which the seed is an important part of the forage, should not be cut until the earliest pods begin to mature, but perennial legumes, such as alfalfa and the clovers, should be cut as soon as they are well in bloom.

It is impossible to give definite rules for making and curing hay, as the processes must change with the kinds of plants from which the hay is made, with the yield, and with the climate. There are, however, a few general principles which should always be observed.

The best hay made from any crop is always that which is made the most quickly and with the least exposure to sun and air. Too much exposure to the sun bleaches the hay, making it less attractive when placed on the market and also less palatable and less digestible. Nearly all kinds of hay should be put in the windrow the day after they are cut, and many of the finer and lighter kinds, like Bermuda

grass, Natal grass, and redtop, should be put in the shock. Even slow-drying hays, like cowpeas and alfalfa, should be raked into windrows as soon as well wilted to avoid the loss of leaves when handled too dry, and they can be put in shocks by the second day. (Fig. 9.) After hay has become half dried it will cure perfectly even when in shocks of considerable size, and it is much safer there than on the ground. As soon as the shocks are well cured and even before they become bone dry in the middle they should be hauled to the barn or stack to avoid damage from rain. The bleaching on the outside of the shocks injures the hay, and the sooner it can be put into the barn after being cut the better will be its quality.



FIG. 9.—Placing alfalfa hay in the cock.

PASTURES.

Much of what has been said in relation to the formation of meadows applies equally well to the formation of pastures, except that in a field designed for a permanent pasture a much greater variety of plants is desirable. Bermuda grass and carpet grass are the foundation of all good permanent pastures in the cotton region, the former being superior on all heavy soils, the latter on lighter sandy soils. One or both of these grasses, together with any others that promise success, should be planted in every pasture. In the South pastures should give good grazing during eight or nine months of the year and some grazing during the other three or four months. While Bermuda grass and carpet grass are superior for general use, both start slowly and when first planted should be supplemented with some kind of rye-grass for a quick winter growth, orchard grass for woods pastures, redtop for wet ground, and Dallis grass for heavy

clays. Every permanent pasture should have a good proportion of legumes, and of these lespedeza, melilotus, bur clover, vetch, white clover, and alsike clover are the most satisfactory. Lespedeza is best for the dry clay hills and melilotus for lands rich in lime, and lespedeza, bur clover, and the vetches are valuable additions to Bermuda grass sod. White clover comes in naturally in every pasture, and alsike clover should be sown on all wet or heavy soils.

Wild lands will furnish a certain amount of grazing, and even when they can not be plowed their natural condition can often be greatly improved by going over them with a heavy harrow or a disk and then seeding with forage crops suited to the conditions. To make a good pasture on land which has never been cultivated is a very slow process. Wherever it can be done it will pay to plow and harrow the ground, even where trees and stumps are so numerous that not more than half the surface can be disturbed. A really good pasture requires as good soil, as much work in its preparation, and as careful handling as any field on the farm. After the ground has been plowed or disked and the seed sown, grazing should be delayed until the young plants become so firmly rooted that they will not be pulled out by the grazing animals. When seeding is done in the fall the field should never be grazed until the spring growth is well started.

PASTURE WEEDS.

There are two weeds which sometimes make serious trouble in permanent pastures—the bitterweed and the garlic, or wild onion. Bitterweed may be held in control by mowing often enough to prevent its seeding, usually twice in a season. The destruction of the wild onion is a more difficult matter. It can be killed by a very deep plowing of the ground in September or October, followed by a very shallow plowing in the spring, and then planting the field with some cultivated crop. However, this method can not be followed in an ordinary pasture where there are many trees or in any pasture without destroying the grass and so making the field useless as a pasture for about 18 months. When a pasture is not infested it should be watched closely, and any wild onions which make their appearance should be removed promptly.

TEMPORARY PASTURES.

Temporary pastures for summer use require less attention to planting than to fencing, as nearly every field will give a few weeks of good grazing in the intervals between the regular crops, and when properly fenced will give most of the summer grazing needed on farms where cotton and grains are the principal crops. Winter pastures need special preparation and care and are practically limited to the growing of small grains and vetches for horses and

cattle. Rye, where it can be successfully grown, makes an excellent winter pasture. Oats or wheat and vetch make the very best grazing from December to April and the best pasture for dairy cows. At the Mississippi Agricultural Experiment Station a mixture of turf oats and hairy vetch has been in use many years, the seeding being done in September and the fields ready for grazing in December, when the growth is usually sufficient to support three cows per acre, which number can be largely increased as the season advances. Horses and mules do not eat the vetch greedily, but the oats or wheat give them good grazing from January to April, when the permanent pastures begin to furnish abundant feed. One bushel of turf oats or wheat and a peck of vetch seed are sufficient for sowing an acre, while if the Rustproof oat is used the quantity should be increased about one-half.

It is sometimes difficult to secure constant fresh grazing in the northern part of the cotton region in unfavorable seasons, but in the central and southern parts it is quite possible to have pasture crops, especially for cattle and hogs, during the entire year. Among the crops which can be used for this purpose are the following:

January and February: Wheat, oats and vetch, artichokes, rape, bur clover, velvet beans.

March: Oats and vetch, artichokes, rape, bur clover, crimson clover.

April: Oats and vetch, rape, bur clover, alfalfa, crimson clover.

May: Oats and vetch, rape, red clover, alfalfa, crimson clover.

June and July: Sorghum, cowpeas, red clover, alfalfa, Rhodes grass.

August: Sorghum, cowpeas, soy beans, alfalfa.

September and October: Sorghum, cowpeas, soy beans, chufas, sweet potatoes, Rhodes grass, corn, peanuts.

November: Cowpeas, soy beans, chufas, sweet potatoes, corn, rape, peanuts.

December: Cowpeas, chufas, sweet potatoes, corn, rape, velvet beans.

It is not to be expected that all of these will do well on any one plantation, but a selection can be made from the list to fit conditions on nearly any farm.

SILAGE CROPS.

While the silo is of less importance in the cotton region than in regions of shorter grazing seasons, it is usually a profitable investment for the dairyman. It provides supplies of succulent feed through the dry weather, which is almost sure to occur in late summer, as well as in the winter when the pastures are too scant or too wet for grazing. Corn and sorghum are the principal crops for making silage, but the quality of the feed made from them is greatly improved when mixed with even a small proportion of some legume, like cowpeas, soy beans, or beggarweed.

Some of the early-ripening varieties of velvet beans, like the Alabama and the Yokohama, are often used, as the vines twine about the corn so that they can be handled easily when being run through the

cutter and still do not grow sufficiently large to tangle the corn. Silage made from this mixture is likely to be very dark in color, but is sweet and nutritious and is eaten readily.

A mixture of beggarweed and cowpeas or soy beans is often used in the sandy coast region, the beggarweed stems making the pea vines much easier to handle and being of the highest value for giving a "June" flavor to winter butter. It is seldom possible to have enough of this mixture to fill the silo, but if as much as one-tenth of the bulk is of this and the remainder corn the whole contents of the silo will be flavored. For the bulk of the silage, corn is usually preferred to sorghum. The largest growing varieties of corn should be used and should be planted much more thickly than for grain. The crop should be ensiled when the kernels begin to glaze and before the lower leaves become dry. Sorghum is often used for silage and has the advantage of remaining green and in good condition much later in the season, thus lengthening the period during which the silo may be filled.

Japanese sugar cane is also valuable for silage, some preferring it to either corn or sorghum, particularly for dairy cows. The outside covering of cane is very hard, and if cane is used it should be cut into very short pieces so that the covering will be partially crushed and will not cut the mouths of the cattle.

SOILING CROPS.

Soiling is often more economical than grazing, especially where land is expensive, as it enables the farmer to keep fully three times the number of animals on the same area. Its principal use is for the dairy. Though the character of the feed is practically the same as that from temporary pastures it is used much more economically, being gathered only as needed and without injury to the roots, so that the plants make a second growth much more quickly and vigorously than when grazed and trampled. One successful dairyman near Harmony, Ga., reports that he keeps an average of 5 cows per acre with his soiling crops, while another near Atlanta states that he kept 25 cows in good condition from the middle of June until the last of September by the use of Amber sorghum grown on 2½ acres.

A profitable soiling crop requires a rich soil in good condition, and the field should be near the feeding lot, to save labor in hauling. The most productive soiling crops for general use are oats, vetch, and alfalfa for March, April, and May; alfalfa and Johnson grass for May and June; alfalfa, millet, and sorghum from June to October. Of course, the choice must depend largely on the location and soil of the particular field on which the crop is to be grown. On soils where alfalfa can not be grown it is generally possible to use vetches, cowpeas, or soy beans in its place. On very rich soil in the extreme

South teosinte makes a heavier yield than any other forage crop. In the southern half of the cotton region Napier grass outyields most other crops and makes a high quality of feed. Many prefer rye or wheat to oats for an early crop, while rice is valued highly in sections where it can be grown. Guinea grass gives frequent and heavy cuttings along the Gulf coast and in Florida, and German millet is ready for use in about 40 days from planting. It is usually better to make successive plantings of annual soiling crops, so that all the crop from each planting can be used just as it reaches its best condition and before it becomes so mature and dry as to lose its succulency. Soiling crops are always profitable when a large quantity of fresh feed is wanted from a limited area of ground, but less so when good summer pastures are available.

RECOMMENDATIONS BY THE AGRICULTURISTS OF SOUTHERN EXPERIMENT STATIONS.

Owing to the great number of forage crops adapted to the cotton region there is room for considerable difference of opinion as to the best sorts for use in any given locality. Table I summarizes the recommendations of the experts at each of several southern experiment stations. These recommendations were given, on request, by Prof. C. B. Williams, of North Carolina; Prof. C. B. Blackwell, of South Carolina; Director P. H. Rolfs, of Florida; Director J. F. Duggar, of Alabama; Director E. R. Lloyd, of Mississippi; Director W. R. Dodson, of Louisiana; Director Martin Nelson, of Arkansas; and Prof. A. B. Conner, of Texas. Corn is intentionally omitted from this table, except as to Florida, because it is considered primarily a grain crop, though also furnishing much forage and often grown for forage alone.

TABLE I.—Forage crops recommended for certain States in the cotton belt.

| Character of crop. | Florida (Rolls). | Eastern Texas (Conner). | Arkansas (Nelson). | Alabama (Dugger). | Mississippi (Lloyd). | North Carolina (Williams). | Louisiana (Dodson). | South Carolina (Blackwell). |
|----------------------------------|--|---|---|--|--|--|---|---|
| Annual winter crops for hay. | Oats..... | Hay vetch, oats. | Rye, oats, hairy vetch. | Oats, hairy vetch. | Oats, hairy vetch, crimson clover. | Oats, oats and vetch, crimson clover. | Oats, hairy vetch, red clover, crimson clover. | Oats, hairy vetch, rye, wheat. |
| Annual summer crops for hay. | Cowpea, beggarweed, soy bean, sorghum, Mexican clover, crab-grass, millet. | Cowpea, sorghum, peanut, Sudan grass. | Cowpea, sorghum, soy bean, lespe-deza, oats, Sudan grass. | Cowpea, sorghum, lespe-deza, soy bean. | Cowpea, lespe-deza, peanut, sorghum, soy bean. | Cowpea, soy bean, sorghum. | Cowpea, lespe-deza, peanut, soy bean, and sorghum mixed (for hill soils). | Cowpea, sorghum, soy bean, German millet, sweet-potato vines, Sudan grass, velvet bean. |
| Annual crops for winter pasture. | Velvet bean, rape, oats, rye. | Oats, bur clover, rescue grass. | Rye, bur clover, crimson clover. | Bur clover, oats and vetch, rescue grass, rye. | Oats, barley, rye, bur clover, rescue grass, hairy and common vetch. | Oats, oats and vetch, crimson clover, rye, Canada field peas and oats, rye and crimson clover, bur clover, rape. | Oats, rye, rescue grass, velvet bean. | Barley and vetch, oats and vetch, wheat and vetch, rye and vetch, crimson clover, bur clover, Italian rye-grass, velvet bean. |
| Annual crops for summer pasture. | Sorghum, peanut, crab-grass. | Cowpea, lespe-deza, peanut, soy bean, sorghum. | Cowpea, lespe-deza, peanut, soy bean, sorghum. | Lespe-deza, soy bean, peanut, cowpea. | Cowpea, lespe-deza, soy bean, peanut, sorghum. | Cowpea, lespe-deza, soy bean. | Lespe-deza, cowpea, peanut. | Cowpea, soy bean, peanut, chufa, lespe-deza, white clover. |
| Permanent hay meadows. | Rhodes grass, Para grass, Natal grass, (central and southern Florida), Johnson grass. | Orchard grass, Bermuda grass and lespe-deza mixed. Alfalfa, Johnson grass, oat-grass, like clover, redtop, timothy, and red clover mixed. Alfalfa, Johnson grass. | Orchard grass, tall meadow oat-grass, like clover, redtop, timothy, and red clover mixed. Alfalfa, Johnson grass. | Alfalfa, Johnson grass, mellotus, Bermuda grass, and lespe-deza mixed. | Bermuda grass, Johnson grass, alfalfa, mellotus, red clover. | Redtop, orchard grass, alfalfa, clover, mammoth clover, and timothy mixed. | Bermuda grass mixed. Alfalfa, Johnson grass, carpet grass, paille fine. | Johnson grass, Bermuda grass, redtop, orchard grass, perennial rye-grass, Dallis grass, and lespe-deza mixed. |
| Best permanent pastures. | Bermuda grass, Dallis grass, Para grass, (central and southern Florida), Carib grass, Johnson grass. | Bermuda grass, carpet grass, lespe-deza, white clover, and bur clover mixed. Redtop, orchard grass, and alfalfa clover mixed. | Bermuda grass, lespe-deza, white clover, and bur clover mixed. Redtop, orchard grass, and alfalfa clover mixed. | Bermuda grass, and bur or white clover mixed. Johnson grass and bur clover mixed. ² | Bermuda grass, lespe-deza, bur clover, white clover, Johnson grass, redtop, orchard grass, and mellotus mixed. | Bermuda grass and lespe-deza mixed, for uplands in the Coastal Plain. ³ | Bermuda grass, carpet grass, lespe-deza, bur clover and white clover mixed. | Alfalfa, Rhodes grass, Bermuda grass, lespe-deza, white clover, and Dallis grass mixed. |

¹ For northern and western Florida.

² Orchard grass should be added on good uplands and redtop on moist lowlands.

³ Redtop, perennial rye-grass, tall meadow oat-grass, and alfalfa clover mixed, for lowlands in the Coastal Plain; orchard grass, redtop, bluegrass, and red clover mixed, for the Piedmont Plateau and mountain uplands.

INDEX TO GRASSES AND FORAGE CROPS.

[The page numbers of the principal entries are in heavy-face type.]

| | Page. | | Page. |
|--|--|--|-----------------------|
| Alalfa..... | 21, 29-31 , 35, 53, 56, 58, 59, | Grass, Australian oats..... | 20-21 |
| Alsike clover..... | 32-33 , 57 | Bermuda..... | 5-8 , |
| Annual yellow melilotus..... | 32 | 19, 35, 41, 52, 53, 55-57 | |
| Artichoke, Jerusalem..... | 47, 50 , 58 | Carib..... | 13 , 54 |
| Australian oats..... | 20-21 | carpet..... | 8-9 , 56 |
| Barley..... | 23 | cereals..... | 23 |
| Bean, soy..... | 37-38 , 55, 58, 59 | Colorado..... | 23 |
| velvet..... | 38-42 , 58 | Dallis..... | 10-11 , 54, 56 |
| Beggarweed, Florida. 44-45 , 48, 54, 58, 59 | | fodder, coarse..... | 23-28 |
| Bermuda grass..... | 5-8 , | golden-crown..... | 10 |
| 19, 35, 41, 52, 53, 55-57 | | Guinea..... | 13-14 , 60 |
| grass, giant..... | 7 | Johnson.... 9 , 13-14, 43, 52-53, 55, 59 | |
| Black medic..... | 34-35 | kikuyu..... | 17-18 |
| Bluegrass, Kentucky..... | 20 | meadow..... | 51-55 |
| Bokhara clover..... | 31 , 32, 57 | Merker..... | 28 |
| Bull-grass..... | 11 | Napier..... | 24, 27-28 , 60 |
| Bur clover..... | 21, 35, 57, 58 | Natal..... | 16-17 , 54, 56 |
| Cane, Japanese sugar..... | 24, 26-27 , 59 | orchard..... | 19 , 21, 56 |
| Louisiana sugar..... | 26-27 | paille finne..... | 18-19 , 54 |
| maiden..... | 18-19 | Para..... | 11-13 , 14, 54 |
| Carib grass..... | 13 , 54 | pasture crops..... | 5-23 , 61 |
| Carpet grass..... | 8-9 , 56 | rescue..... | 20-21 |
| Cassava..... | 47, 50-51 | Rhodes..... | 14-16 , 54, 58 |
| Chufa..... | 47, 49 , 58 | St. Lucie..... | 7 |
| Clover, alsike..... | 32-33 , 57 | Schrader's..... | 20-21 |
| Bokhara..... | 31 , 32 | Sudan..... | 10 |
| bur..... | 21, 35, 57, 58 | Vasey..... | 11 |
| crimson..... | 33-34 , 55, 58 | water..... | 10 |
| Japan..... | 34 , 54, 57 | Guinea grass..... | 13-14 , 60 |
| Mexican..... | 47, 48 , 54 | See also Johnson grass..... | 13 |
| red..... | 32 , 53, 58 | Herd's-grass..... | 20 , 33, 56 |
| white..... | 33 , 57 | Japan clover..... | 34 , 54, 57 |
| white sweet..... | 31 , 32 | Japanese sugar cane..... | 24, 26-27 , 59 |
| Colorado grass, or Texas millet.... | 23 | Jerusalem artichoke..... | 47, 50 , 58 |
| Corn..... | 39-41, 43, 55, 58 , 59 | Johnson grass... 9 , 13-14, 43, 52-53, 55, 59 | |
| Cowpea..... | 12, | See also Guinea grass..... | 13 |
| 35-37 , 51, 54, 55, 56, 58, 59 | | Kentucky bluegrass..... | 20 |
| Crab-grass..... | 17 , 23, 44, 48, 54 | Kikuyu grass..... | 17-18 |
| Crimson clover..... | 33-34 , 55, 58 | Kudzu..... | 45-47 |
| Dallis grass..... | 10-11 , 54, 56 | Large water grass..... | 10 |
| Florida beggarweed. 44-45 , 48, 54, 58, 59 | | Legumes..... | 28-47 |
| Giant Bermuda grass..... | 7 | Lespedeza..... | 34 , 54, 57 |
| Golden-crown grass..... | 10 | Louisiana sugar cane..... | 26, 27 |